



The Blast Furnace and Steel Plant

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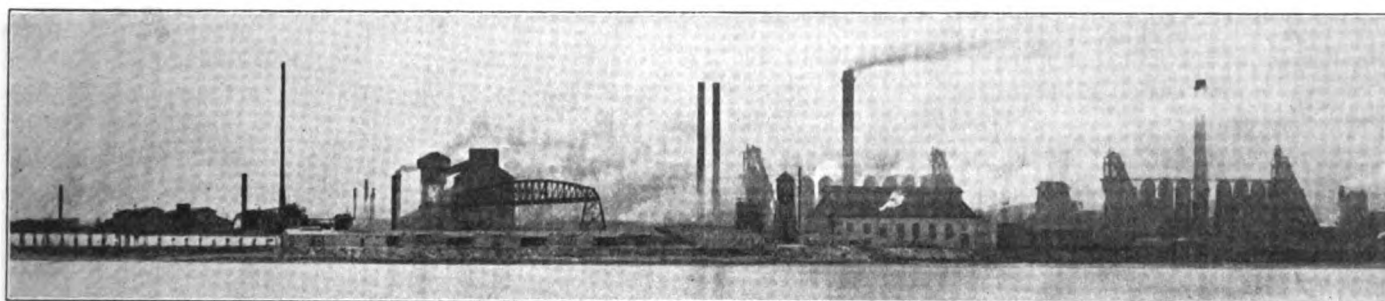
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The Blast Furnace *and* Steel Plant

Baltimore Scene of Important Convention

Eleventh Annual Meeting of the Association of Iron and Steel
Electrical Engineers to Be Held September 11 to 14—Interesting
Technical Program to Be Presented.



Sparrows Point plant of the Bethlehem Steel Company, showing blast furnaces, ore bridges, etc.—This plant will be visited by the Iron and Steel Electrical Engineers.

SEPTEMBER 11 to 14 will mark one of the most important dates in the history of the A. I. S. E. E., when the eleventh annual convention will be held at the Southern Hotel, Baltimore, Md. The technical program will be of unusual interest, although the entertainments will not be as lavish this year as in previous years, due to the war policy of the association, it having been decided that expenditure on entertainment would not be patriotic, nor would it be in accordance with the policy of the government.

The papers which will be read are of particular interest to the industry during present war conditions. Following the business session to be held for members only on Wednesday, the afternoon program will be opened by the reading of a paper prepared by the Safety Committee, and entitled, "Rules for Safe Operation of Electric Cranes." This paper takes up suggested rules applicable to cranes actuated entirely by electric current. The paper is largely devoted to specific rules for the safe operation of electric cranes. Following this discussion the Educational Committee will present a paper on "Methods of Education for Electrical Employees." This paper has as its purpose the solution of the "man" problem and endeavors to suggest the most practical manner for educating electrical employees with the view of reducing the cost of labor turnover. Following this, Walter Greenwood, safety engineer of Ohio Works of the Carnegie Steel Company, will read a paper on "Automatic Engine Stops." The paper briefly tells why speed reg-

ulators can fail and why substitutes should be provided for such emergencies, also alludes to the causes for failure of stops, and shows how they can be avoided; dwells on the superiority of electrically operated stops over mechanically in that the range of methods for bringing them into operation when needed, is more extensive, requiring but inexpensive additions to equipment. It points out the best features of stops, made by the various makers; what combinations of these should be preferred, and how the office of automatic engine stops can be extended.

On Thursday morning R. H. McLain, of the power and mining department of the General Electric Company will discuss "Bridge-Motors for Overhead Traveling Cranes." This paper presents in tabulated form the tests of rolling friction and rate of acceleration on several manually controlled crane bridges. General rules for guidance in applying motors are developed based on kind of control (manual or magnetic), nature of work and number of wheels driven. A graph shows a convenient method of checking motor size and gear ratio.

This paper will be followed by one to be read by D. D. Pendleton, of the Wheeler Condenser & Engineering Co., which will be a general discussion of modern manufacturing practice and ratings; types of condensers and auxiliaries, their power requirements and practical limitations. Lantern slides will be shown to illustrate this paper entitled "Condensers and Condenser Engineering."

The Thursday afternoon session will be opened by K. A. Pauly, of the General Electric Company, with a

paper on "Standardization of Ratings of Large Rolling Mill Motors." This article points out some of the difficulties of the users of large rolling mill motors due to the present difference in methods of rating their motors by manufacturers. It is suggested that these motors be rated on their continuous capacity at some particular temperature rise, preferably that selected by the A. I. S. E. E., which is 50 deg., the maximum overload capacity to be given in the specifications. J. T. Sturtevant's paper on "Electrically Driven Mills" will describe the layout, equipment, power consumption and tonnage on 11 installations at the Lehigh plant of the Bethlehem Steel Company, on which type I, form M., G. E. induction motors are used. The author is master mechanic and chief electrician of the merchant mills of the Bethlehem Steel Company, at South Bethlehem, Pa.

On Thursday afternoon a patriotic meeting will be held which, with the annual banquet in the evening, will be addressed by prominent speakers whose names are not announced as yet.

The opening paper of the next day will be read by W. T. Snyder, of the National Tube Company, McKeesport, and past president of the A. I. S. E. E.. Mr. Snyder's paper on "Remote Controlled Sub-Station," will describe a remote controlled motor generator sub-station, located about 2,200 feet from main power station and feeding into a 250-volt d.c. transmission line. The sub-station is controlled by regular switchboard attendant at main power station, no attendant being required in sub-station. Diagrams of complete generating and transmission system will be presented.

The technical sessions will be concluded by the report of the Standardization Committee of 1918.

On Friday afternoon the members of the association will inspect the furnaces, steel works and ship yards of the Bethlehem Steel Company, at Sparrows Point. This plant is eight miles from the center of Baltimore. It is now ranked as one of the leading plants in the United States. Iron ore comes from its own mines in Cuba and is unloaded from steamers by two Brownhoist electric ore unloaders at the rate of 400 tons per hour. A bridge with a bucket of 15 tons capacity puts the ore into stock and 75,000 to 100,000 tons per month is imported. The ore is reduced to pig iron by four blast furnaces, each of 450 tons capacity.

A by-product coke plant of 120 ovens, having each a 24-hour capacity of 11 tons, furnishes 4,000,000 to 8,000,000 cubic feet surplus gas per day, which is pumped to Baltimore—other by-products being tar and sulphate of ammonia.

The steel department has three 15-ton Bessemer converters, five 50-ton Campbell open hearth furnaces of the tilting type and a 1,000-ton hot metal receiver.

The rail mill has a capacity of 1,800 tons a day and produces either rails or billets.

Its marine department builds tugboats, barges, freight and passenger steamers, carfloats and floating drydocks.

It will be of interest to the members of the A. I. S. E. E.

that the Electric Welding Committee of the Emergency Fleet Corporation will hold a joint session with the Philadelphia sections of the A. I. and S. E. E. and A. I. E. E., and the Engineers Club, of Philadelphia, at the Bellevue-Stratford Hotel, Philadelphia, September 16, at 8 p. m., at which meeting the very important and timely subject "Electric Welding a New Industry" will be discussed.



JAMES H. PRESTON
MAYOR

Mayor's Office,

BALTIMORE, MD. August Sixth,
1918.

TO THE ASSOCIATION OF IRON & STEEL ELECTRICAL ENGINEERS:

Baltimore looks forward to the meeting of the annual convention of the Iron & Steel Electrical Engineers with a great deal of pleasure and interest.

Baltimore from its geographical location on the Atlantic Seaboard, from the advantages derived from the freight differential amounting to from \$18.00 to \$50.00 a car, from its location mid-way between the North and South, from the advantages of its thirty-five foot deep direct channel from the piers to the ocean and from the great ship building and steel plants, all render Baltimore a fruitful field of interest and profit to the Iron & Steel Electrical Engineers.

Our great electric plant at the McCall's Ferry produces electricity more cheaply than any other similar plant in the United States; and in Baltimore power is obtainable at a lower rate than that of any other great City in the country; offering thereby exceptional opportunity for the investment of capital on account of this low power rate.

We in Baltimore look forward to the visit of the Association of Iron & Steel Electrical Engineers from the 11th to 14th of September with a great deal of interest, and with the hope that you will find your visit to Baltimore both pleasant and profitable.

James H. Preston
Mayor of Baltimore

Letter of welcome extended to the A. I. S. E. E., by Mayor Preston, of Baltimore.

Remarkable Growth of A. I. S. E. E.

Meetings Held With Manufacturers of Electrical Equipment First Started Organization in 1906—Membership Now Includes Important Electrical Engineers in the Steel Industry.

There has probably never been a time in the history of the steel industry in this country when the opportunities for the work of engineering societies have been as good as they are to-day. It can safely be said that the Association of Iron and Steel Electrical Engineers is one of the most important technical societies in the United States. Due to the specialized field of this society its membership cannot be large, although the society is extremely well organized. At the occasion of the eleventh annual convention of this society, it seems appropriate and of interest to review the growth and development of this organization.

In attempting to review the history of the A. I. S. E. E., the author has carefully reviewed the proceedings of this society and has collaborated with some of the pioneers who were instrumental, both in the original plan and organization and in the remarkable growth.

Prior to the year of 1906, no special motors could be secured on the market for steel mill service. In the year of 1906, however, the Crocker-Wheeler Company designed a special motor for rolling mill work, whereas previous to this date the industry was compelled to use such motors as were found on the market, the street railway types of motors being the most prevalent for cranes, charging machines and roller table work. This important step on the part of the Crocker-Wheeler Company made it necessary for the other large producers of motors to take a similar step and form the basis for specialized electrical development in the steel industry; thus the field for the A. I. S. E. E. was established. In April, 1907, the Westinghouse Electric & Manufacturing Co. invited a number of electrical engineers and superintendents of electrical departments of the steel plants, as their guests at a meeting which was held at their factory. Some 20 or 30 responded to this invitation. These men held meetings, together with representatives of the Westinghouse Electric & Manufacturing Co., at their factory and were entertained in the evening by the Westinghouse company. At a dinner given by the Westinghouse company to these men at the Duquesne Club, James Farrington suggested that a permanent association be formed.

This suggestion was enthusiastically received and the following morning a committee was elected to formulate a constitution and by-laws and empowered to call a convention at a later date. Those selected on this committee were James Farrington, superintendent electrical department La Belle Iron Works, Steubenville, O.; J. C. Reed, electrical engineer, Pennsylvania Steel Company, Steelton, Pa.; G. W. Sturgiss, superintendent electrical depart-

ment, Lackawanna Steel Company, Buffalo, N. Y.; G. H. Winslow, electrical engineer with the Youngstown Sheet & Tube Co., Pittsburgh, Pa., and E. A. Yearsley, electrical engineer of the Midvale Steel Company, Philadelphia.

These men held a number of meetings and drew up the constitution and by-laws as directed. The idea of the association at this time was to confine the membership to those in charge of the electrical departments of the various steel plants.

In October, 1907, the first convention of the association was held at Pittsburgh, the headquarters being the Fort Pitt Hotel, the meetings being held in the rooms of the Western Pennsylvania Engineers' Society. At this meeting, officers were elected as follows: James Farrington, president; J. C. Reed, first vice president; G. W. Sturgess, second vice president; G. H. Winslow, secretary; E. W. Yearsley, treasurer. The constitution provided that these officers, together with the two junior past presidents should form an executive committee to conduct the affairs and business of the association.

This convention was well attended and the membership was considerably increased. The idea at this time was to hold closed meetings, that is, only members were allowed at the meetings, together with the speakers and other representatives of the company represented by the speaker. This custom was carried out for a number of years. This policy enabled the association to criticize freely the manufacturer's apparatus without furnishing sales munition to their competitors, and was the result of the designing and manufacture of new lines of electrical apparatus intended primarily for use in steel plants.

The next convention of the association was held in June, 1908, at Philadelphia, the headquarters being the Walton Hotel and the meetings being held at the Philadelphia Engineers' Club. This meeting was also well attended and was considered to be a very successful convention.

In October, 1908, a convention was held at Chicago, the meetings being held at the Engineers' Club. This marked the beginning of J. C. Reed's term as president of the association, the election resulting as follows: J. C. Reed, president; G. W. Sturgess, first vice president; Lew Palmer, second vice president; G. H. Winslow, secretary, and E. W. Yearsley, treasurer. One of the most important things which occurred at this meeting was the appointment of a safety committee. This was done at the suggestion of Mr. Palmer who was made chairman of the committee, and was the beginning of the safety-first movement on a large scale and afterward

resulted in inviting the safety inspectors of the various steel plants to attend the meetings of the A. I. S. E. E. and considerable time was given to the discussion of safety subjects. These men subsequently formed the National Safety Council, which to-day is a very large organization.

It is of interest to note in connection with the former relationship between the Association of Iron and Steel Electrical Engineers and the National Safety Council, a resolution which was adopted by the former organization and which resulted in the development of one of the largest and strongest societies in the country. Following is the resolution referred to:

Resolutions Adopted.

Whereas, The Association of Iron and Steel Electrical Engineers regarding as worthy of particular attention the hazards to life involved in electrical operations in steel mills, and appreciating the importance of the general safety movement not only in electrical engineering, but also in the steel industry as a whole, and in all the other varied and important industries of our country, and having met with such prompt coöperation in their proposals to establish a national organization devoted to securing increased safety to human life, have reached the conclusion that such an organization can best be brought about by action at this joint meeting of the Association of Iron and Steel Electrical Engineers and the Coöperative Safety Congress, and it is, therefore, hereby

Resolved, That the president of the Association of Iron and Steel Electrical Engineers be requested to take the first steps toward the formation of a national organization for the promotion of safety to human life by appointing a committee on permanent organization, which shall contain representatives of the federal and state agencies already established to supervise conditions of safety in our industries and shall also contain representatives from the mining, transportation and manufacturing industries of the United States, and be it further

Resolved, That the committee so appointed shall be and hereby is authorized by this congress to organize and to create a permanent body devoted to the promotion of safety to human life in the industries of United States; this committee to have authority to call future congresses of safety, increase its membership if it so desires, and to do such other acts as will promote the object for which it is established.

The next meeting of the A. I. S. E. E. was held in June, 1909, at Buffalo. The final meeting of President Reed's term was held at Pittsburgh in October of the same year. During the early days of the association its remarkable growth was due in no small part to the support given by the electrical manufacturers. They supplied a great deal of their best talent with the result that great good was accomplished and advancement was made in the use of electricity in the iron and steel industries. These manufacturers not only contributed liberally in the way of engineers; but were lavish in their entertainment and financial support generally. This action on their part eventually led to the overdoing of this feature and the abolishment of the acceptance of entertainment from the manufacturers by the association and resulted in the

formation of an associate membership into which the representatives of the manufacturers were admitted.

Up to the year of 1913, the membership reached 204, and under the direction of C. W. Parkhurst was increased to 253. During that year there were no radical changes of interest in the policy of the society. A convention was held at the McAlpin Hotel, in New York, from September 22 to September 27, at which 12 papers were read and fully discussed. The social affairs of the convention were handled by Al Swartz, who has so successfully handled all the following conventions. At this convention a joint dinner was held with the National Safety Council. The toastmaster was the Hon. John K. Tener, then governor of the Commonwealth of Pennsylvania. Eugene G. Grace, president of the Bethlehem Steel Company was elected as the third honorary member of the association and spoke at the dinner. Colonel McCleary was one of the speakers.

During W. T. Snyder's term as president the membership increased 28 per cent, making the total 454. In 1917, under F. D. Egan's administration the membership increased to 656.

The expansion of the society in the way of establishing local sections is worthy of note. There are now sections of this society in Pittsburgh, Philadelphia, Cleveland and Chicago. During the past month a permanent office was opened in Pittsburgh, at 513 Empire building. J. F. Kelly now gives his entire time to the work of being secretary of the A. I. S. E. E., having severed his connections with the National Tube Company, at McKeesport.

In connection with the building up of sections of the A. I. S. E. E., the development of the Cleveland district section is of particular interest.

Under this section's direction, the first meeting with a dinner was called for January 26, 1918, and the attendance was so encouraging that the future of the section seemed certain. Several successful meetings have been held since.

L. W. Egan, the Cleveland district section's chairman, together with A. H. Swartz, the entertainment committee's chairman, have been the prime factors in the success of this section. However, deserving credit is due the membership in general and particularly those gentlemen who so willingly and capably presented the technical subjects. The Cleveland district section has, within its territory, 40 active members, 59 associate members, seven active and 10 associate members having been enrolled during the present year.

The development of the A. I. S. E. E. has been exceedingly interesting, and a complete review of the history of this society while interesting, would require an article of greater length than is here possible. Our purpose in this article, therefore, is merely to bring out a few of the outstanding facts concerning the A. I. S. E. E., and not to present a complete history.



Italian War Industry Reaching Maximum Production Crushes Teuton Drive

HARDLY a year ago the armies of the Central Powers, equipped with the most modern, powerful and destructive war machinery that the German Krupp and Austrian Skoda could devise and build, forced the Italian retreat from the Isonzo. Italy stood face to face with the same fate that befell Belgium, Servia and Roumania. Even the most sanguine feared that the name of Italy would be added to this death list. The Italian lines finally strengthened and held. But, would they be able to withstand another enemy onslaught which would surely come? The great drive came! Italian armies and steel once more struggled in a great battle. The enemy advance started, waivered, broke and was turned into one of the most crushing and decisive defeats administered to any army during the entire war. Then the world knew that Italy, besides having a brave army, had more than this—guns, munitions, aeroplanes, cannon, motors, ships. Practically all of these were manufactured by the great steel plants of Italy. The following article graphically describes and illustrates how the Schwab, the Gary and Carnegie of Italy defeated Krupp and Skoda.



Ansaldo Steel Plants Rush Munitions

Gio. Ansaldo & Co., Employing Over 100,000 Men, Manufacture Guns, Cannon, Shells, Aeroplanes, Submarines, Merchant and Battleships—Largely Responsible for Recent Italian Victories.

By MARIO DE BIASI.

Facts have shown that the Italian retreat from the Isonzo was due to the German propaganda which with Bolshevist treacherous system penetrated the rank and file of the Italian army.

Within six months after that disaster, Comm. Pio Perrone, the head of Gio. Ansaldo & Co., of Genoa, wrote to Congressman Captain La Guardia: "We have reconstructed the 3,000 cannon lost at Caporetto. We have re-established the iron wall which was pierced by the enemy's treachery. Our immense task has been accomplished, thanks to the raw materials furnished us by the United States. We beg you to bring to the government and to the people of the United States a message of gratitude for whatever they have done and are doing for Italy."

This prophetic message of Pio Perrone, who occupies the same industrial position in Italy as held by Charles M. Schwab in America, was immediately followed by the Austrian offensive on the Piave this past June. Germany and Austria believed that Italy had been put out of the struggle forever, but, on the contrary, they suffered one of the most memorable defeats of the present war.

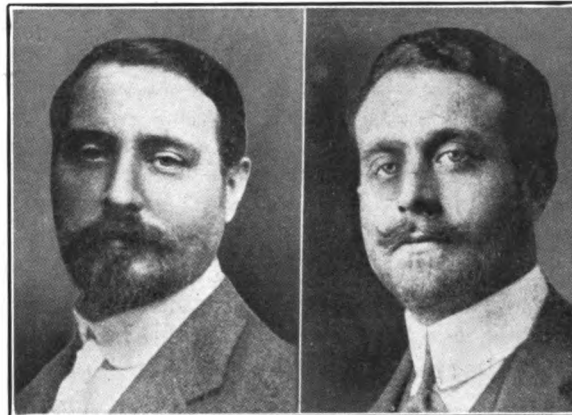
By throwing the enemy across the Piave, Italy has not only reaffirmed the glory of her army, but

has shown herself to be a potent industrial nation. The enemy's downfall was not only a defeat administered to its generals and soldiers, but also to Krupp and Skoda.

Who won? The Italian soldiers and Ansaldo & Co., the great industrial institution of Genoa, which must be rated not only as one of the largest manufacturing companies in Italy, but of the world. It would be difficult to name anything in the mechanical line that is not or cannot be produced in its great shops, from a battleship, complete from hull to engines and armament to a locomotive, from a 381 millimeter cannon to the little trench mortar that can be carried in a man's hands.

A nation like Italy, lacking the two most necessary elements—iron and coal—for the furtherance of a modern conflict, a nation which for over three years has supplied its army of 4,000,000 with arms, ammunition, cannon and aeroplanes, a nation which after having lost 3,000 cannon is able to replace them within a very short period of time, must absolutely be considered a great industrial country.

For Italy's industrial efforts the large part of the credit must be attributed to two persons of extraordinary ability and energy—the brothers Pio and



Comm. Pio Perrone.
Italian steel king.

Comm. Mario Perrone.
Italian steel king.

The Blast Furnace and Steel Plant

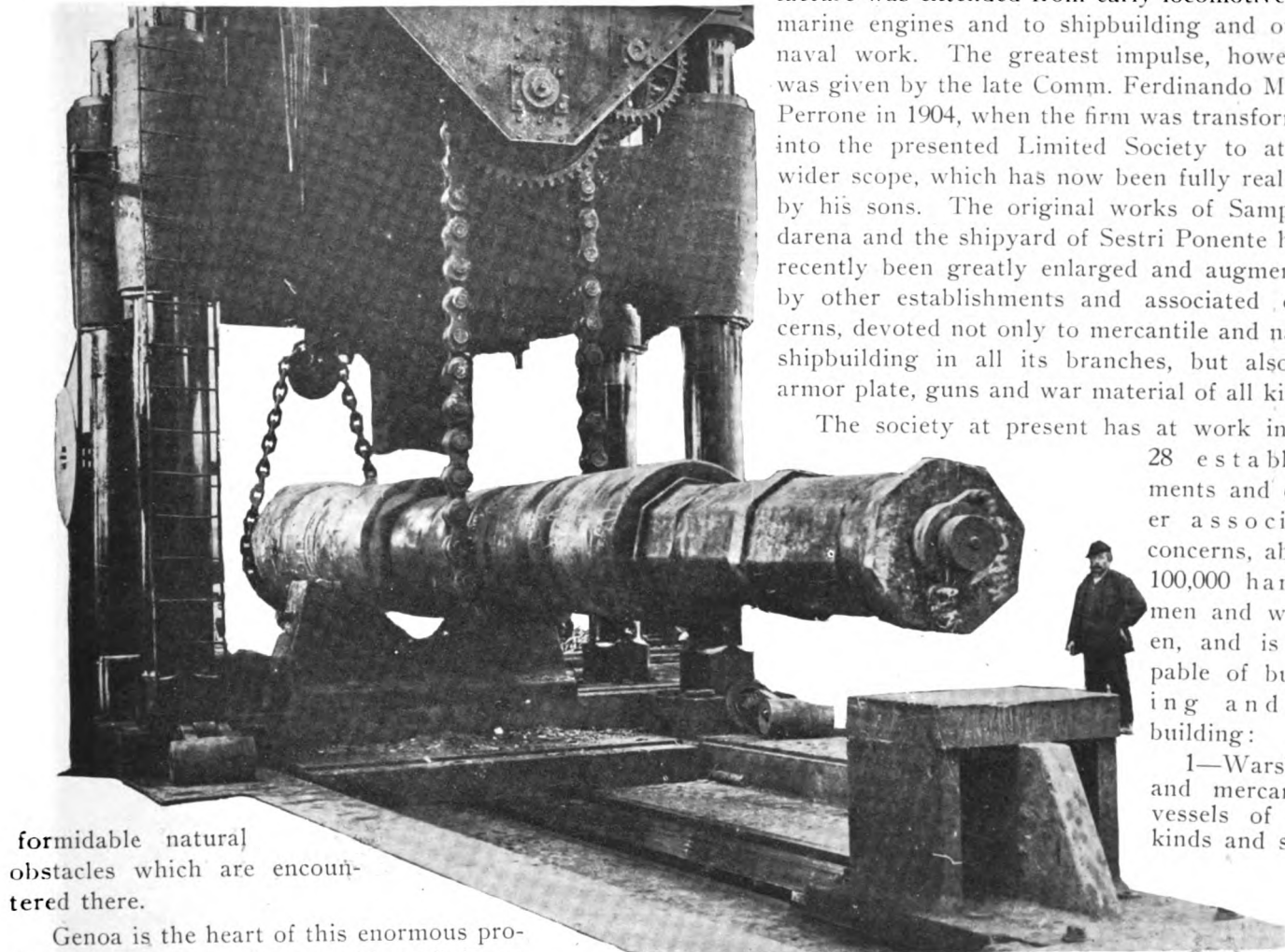
Mario Perrone, principal directors and stockholders of Gio. Ansaldo & Co. They are supplying the Italian Army and Navy with a constant stream of ammunition and guns of all sizes, with an indomitable will to win the war. With immense industrial energy these men have succeeded in directing thousands of their workmen in producing the enormous quantity of projectiles, cannon, machine guns, explosives, submarines, trucks, tractors, and other thousands and one things needed for an army of millions; an army which is fighting from the mountains to the sea, on a vast front—the most difficult of all front, owing to the

of causing the industrial and economic independence of Italy to march abreast with her political revival. He had the firm entrusted to Giovanni Ansaldo. What was once a little workshop, giving employment to less than 100 operators became under the able management of the new chief a large mechanical and naval establishment known as the Gio. Ansaldo & Co.

Giovanni Ansaldo is to be considered one of the most illustrious pioneers of the Italian industry. After his death, the firm had, especially under the subsequent management and direction of the Bombrini Bros., a prosperous career, during which the manufacture was extended from early locomotives to marine engines and to shipbuilding and other naval work. The greatest impulse, however, was given by the late Comm. Ferdinando Maria Perrone in 1904, when the firm was transformed into the presented Limited Society to attain wider scope, which has now been fully realized by his sons. The original works of Sampierdarena and the shipyard of Sestri Ponente have recently been greatly enlarged and augmented by other establishments and associated concerns, devoted not only to mercantile and naval shipbuilding in all its branches, but also to armor plate, guns and war material of all kinds.

The society at present has at work in its 28 establishments and other associate concerns, about 100,000 hands, men and women, and is capable of building and is building:

1—Warships and mercantile vessels of all kinds and sizes



formidable natural obstacles which are encountered there.

Genoa is the heart of this enormous production. "Genoa, the magnificent," is an Italian Pittsburgh. The establishment of Gio. Ansaldo & Co. is the spinal cord of this wonderful achievement.

Before the war, Gio. Ansaldo & Co. were known in Europe and South America. To-day the United States is very well aware of their existence.

The firm was established in 1846 by Taylor and Prandi. Owing to the limited proportions of the plant and to the scantiness of its machinery, only the most urgent repairs to ships anchored in the port of Genoa were attempted. At that time the destinies of Italy were undergoing immense changes. The prophetic brain of that calm master molder of events and men—Camillo Benso di Cavour—conceived the vast scheme

Forging large gun barrel.

from big super-dreadnaughts and ocean liners to destroyers, torpedo boats, submarines, cargo steamers, tug boats, motor boats, etc.

2—Diesel marine oil engines up to 2,000 h. p., also marine steam propelling engines, both reciprocating and turbine engines with and without gearing.

3—Steam boilers, both water-tube and cylindrical, of all types and sizes.

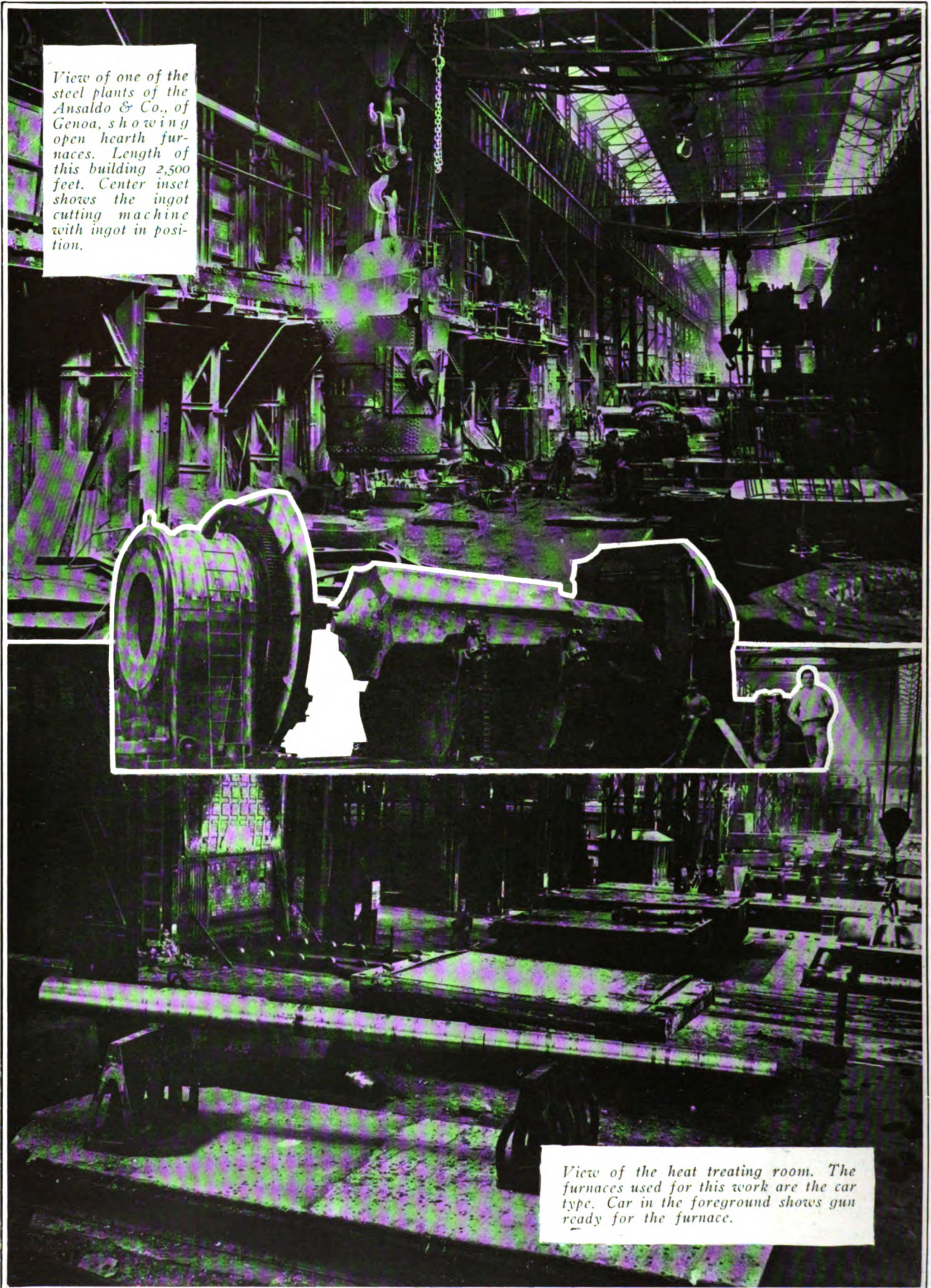
4—Locomotive and tenders complete, and machine tools.

5—Armor plates, guns, armored turrets complete, ammunition complete, metallic cartridges and casings.

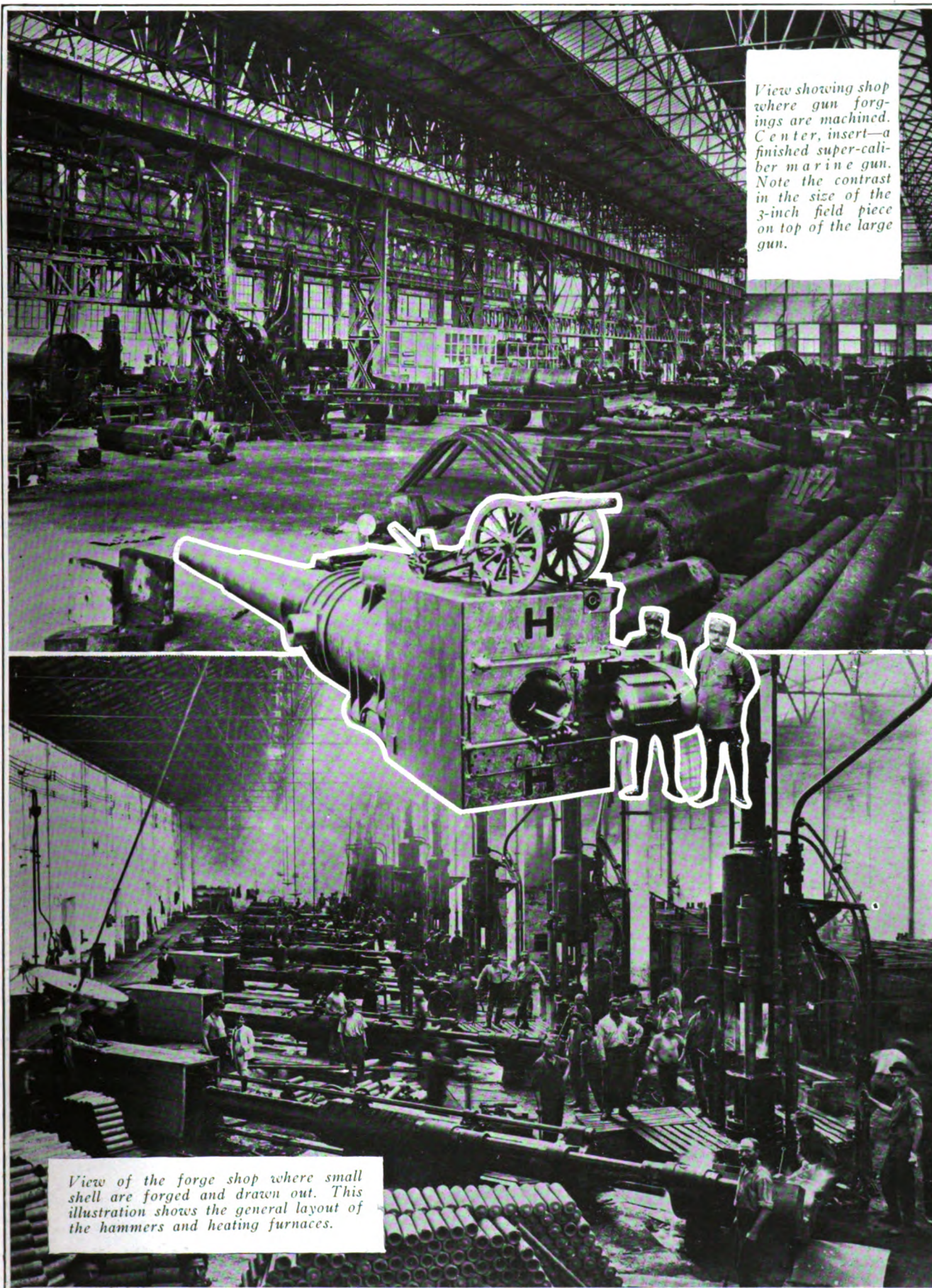
6—Auxiliaries for propelling machinery, and all kinds of auxiliary machinery for ships, such as steer-

The Blast Furnace Steel Plant

View of one of the steel plants of the Ansaldo & Co., of Genoa, showing open hearth furnaces. Length of this building 2,500 feet. Center inset shows the ingot cutting machine with ingot in position.



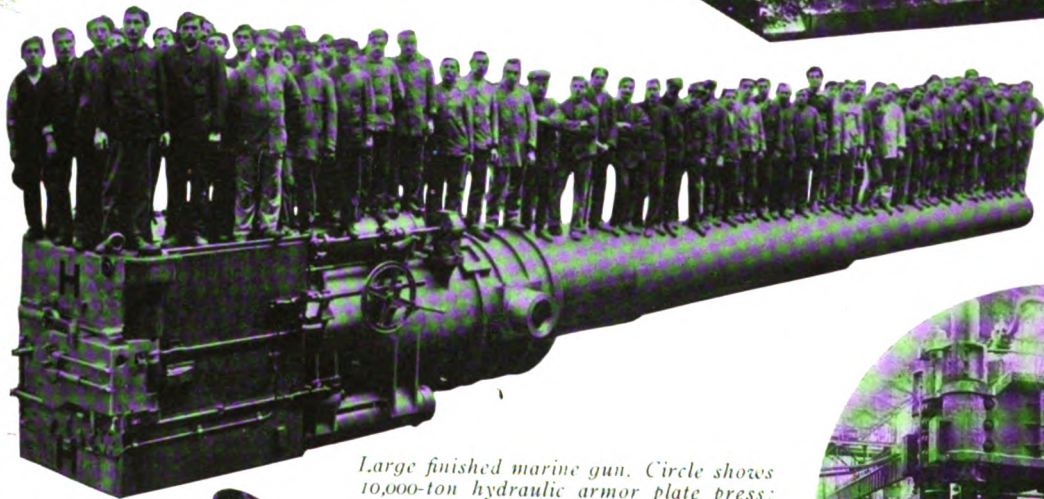
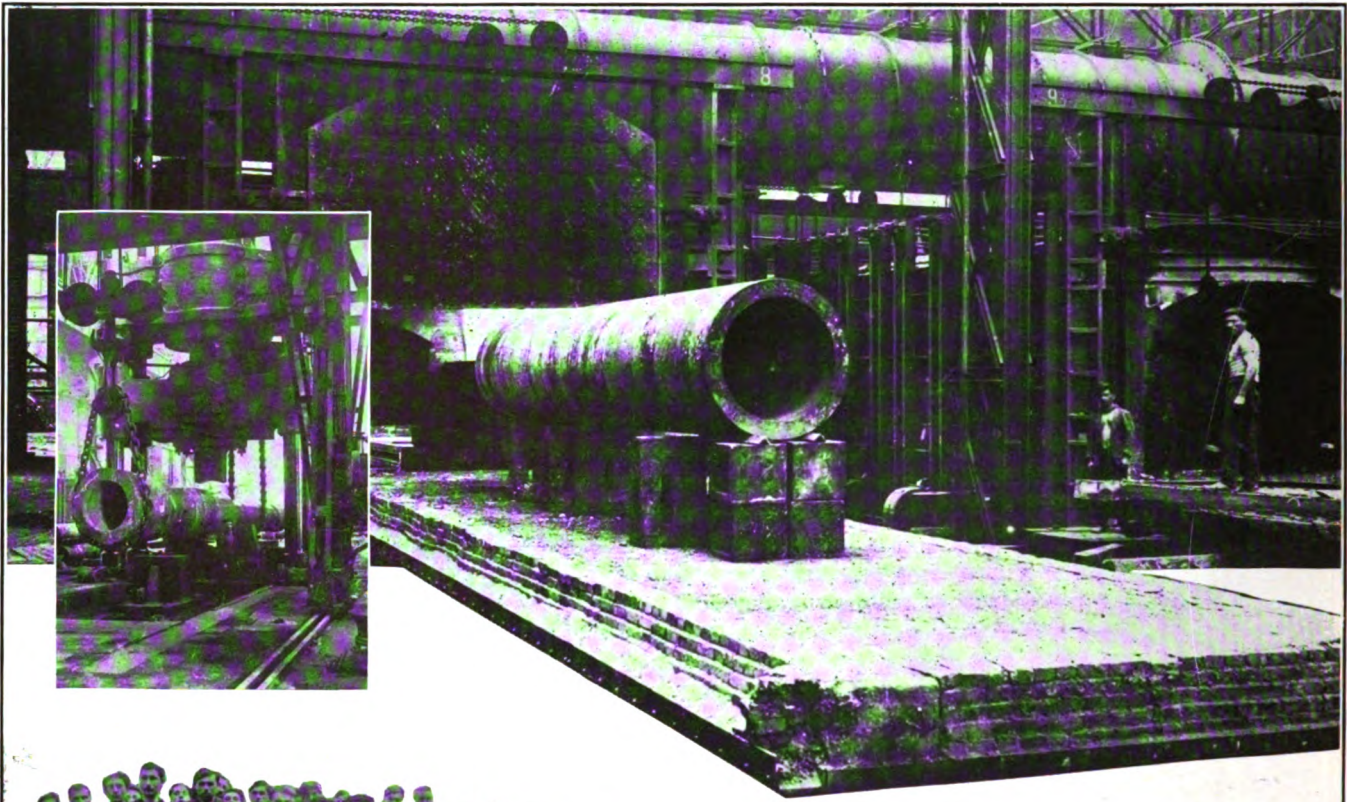
View of the heat treating room. The furnaces used for this work are the car type. Car in the foreground shows gun ready for the furnace.



View showing shop where gun forgings are machined. Center, insert—a finished super-caliber marine gun. Note the contrast in the size of the 3-inch field piece on top of the large gun.

View of the forge shop where small shell are forged and drawn out. This illustration shows the general layout of the hammers and heating furnaces.

The Blast Furnace and Steel Plant



Forgings are heated in large heat treating furnaces. Forging press shown in inset.

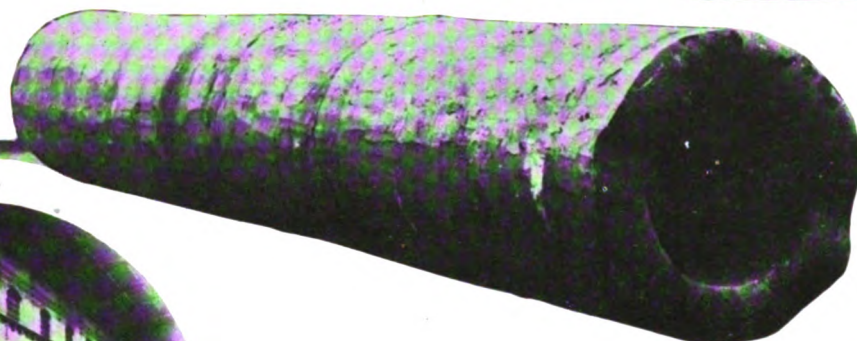
Large finished marine gun. Circle shows 10,000-ton hydraulic armor plate press; 15,000-ton press for plates shown below. Note manufacturer's name and date on the large press.



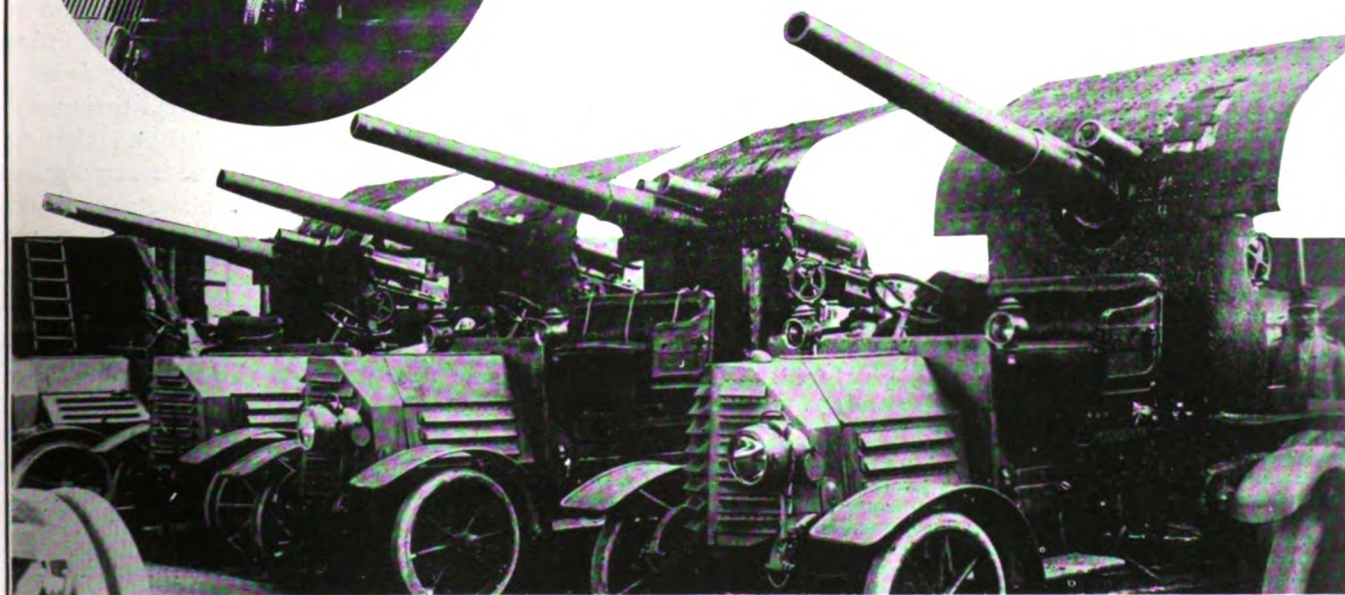
The Blast Furnace Steel Plant



Women alone are employed in this shell finishing department. Insert on the right shows a large steel casting for a marine gun carriage.



Immense marine gun forging shown above. Interior view of marine boiler shop is shown in the circle to left. Anti-aircraft guns ready for action below. These guns as shown in the illustration are assembled at the plant and transported to the front.



ing gears, capstans, winches, distilling condensers and screw propellers.

7—Dynamo and all electric appliances, auxiliary electric machinery, both for ship and land service, electric gear for turrets and guns, elevators, steering gears, electric capstans and winches, cranes and electric propelling machinery.

8—Aeroplanes and their motors.

9—Steel, cast iron and bronze castings of all varieties and sizes.

10—Steel forgings of all kinds and sizes, special steels and files.

11—Boiler steel tubes, steel, iron, copper and brass pipes.

12—Furniture of all description, both wood and metallic, for warships, liners and mercantile vessels.

The establishments are the following:

General engineering works; locomotive construction works; artillery and big gun works; war munition works; aeroplane motor works, San Martino; cast steel foundry; armor plates and forging plant; oxygen and hydrogen production plant; new artillery and big gun works; electric products plant; bronze foundry; white metal and alloys foundry; Savoia shipyard; internal combustion engine works; Aeroplane works No. 1 (marine hangars); aeroplane works No. 2; aeroplane works No. 3; tube mills; projectile-case works; naval shipyard; saw mill and boat yards; ammunition works; cast iron foundry; firebrick plant; Genoa shipyards; iron mines; electric furnaces for steel and iron; and special alloys plant.

Especially interesting is the electro-metallurgical establishment at Aosta where six electric ovens, Ansaldo type, have been installed. These ovens are to be noticed for their novel electric mechanism. They are capable of 20 tons. In the same establishment other ovens are under construction and there the immense steel foundries and electrical derivations are also to be found.

The following concerns are controlled or associated with the Gio. Ansaldo & Co., of Genoa:

Shipyard and works, Savio; shipyard and works, Fiat San Giorgio; internal combustion engine works, Fiat San Giorgio; ore mines; Italian National S. S. Company; lignite mines; CerPELLI's centrifugal and turbine pump works; Westinghouse Company; magnesite mines.

The Gio. Ansaldo & Co. is also known here because the company owns the Società Nazionale di Navigazione, whose ships ply between Italy and America. This line has seven steamers, besides 26 more of notable tonnage now building in their Italian shipyards. The company has increased its capital from 60 to 150 million francs, with the program in view of solving the transportation problem with Italy which is the chief one during this war and which will be of still greater importance after its termination. The object of the company is also that of ex-

tending its activities towards accommodating and carrying passengers.

If America is justly proud of Schwab, Frick, Grace, Gary and others, Italy, though much more modest in the industrial potentiality, can very well be proud of having at the head of her metallurgical industries the two Perrone brothers, whose sole ambition is that of rendering Italy economically and industrially absolutely independent of Germany, who, before the war, powerfully dominated many of the Italian industries.

To grasp the importance of this Ansaldo concern at Genoa, it is sufficient to compare it with the Bethlehem Steel Corporation in the number of persons both employ. The Bethlehem employs 120,000 and the Ansaldo 100,000 workmen.

The social capital of Gio. Ansaldo & Co., full paid, is of 500,000,000 lire (\$100,000,000).

Its branch in the United States is at 80 Maiden lane, New York City, and is directed by Capt. Sebastiano Raimondo, a man of great energy and capacity, who has solidly affirmed the name of Gio. Ansaldo & Co. in the American industrial field. With business-like acumen and with diplomatic tact, he has succeeded in establishing strong bonds of sincere relations between the concern

he so ably represents, and the foremost industrial steel magnates of the United States and the American and Italian government and diplomatic circles at Washington. Up to date he has expended in this country about \$40,000,000 for iron and steel, destined to the Ansaldo concerns for the war's production.

Italy looks to America as the chief source of supply for raw materials and partly finished or finished materials which she formerly obtained from Germany and Austria. Coal, iron, machinery, lumber, and railroad and shipbuilding materials will be needed in large quantities. She also hopes to obtain directly from this country many things that formerly found their way to farm and workshop through England and Germany.

After the war, as now, Italy will be a very desirable and welcomed client of American iron and steel markets.

The future of the United States and Italy is identical. The shattering of Prussian militarism is for both countries of capital importance. What is mostly needed now is intense coöperation.

At the end of this war Italy will be found bound to the United States by still stronger bonds of friendship and union, and will no longer be subjected to the tutelage which Germany imposed on her previous to the great conflict. The destinies of Italy will summon her some day to be the England of the South. Of this we must be certain if the young Latin nation gains the support of the United States.



Outfitting Italian superdreadnaught.

Nickel and Cobalt Determination in Steel

Elimination of the Bulk of the Iron by Means of Sodium Carbonate — Description of Methods and Analysis — Cobalt and Nickel Titration.

By W. R. SCHOELLER and A. R. POWELL.

The reaction on which our process for determining cobalt and nickel in ores and alloys is based consists in the precipitation of hexammine cobaltous and hexammine nickelous iodides by means of potassium iodide in strongly ammoniacal solution, the precipitation of the trivalent metals by the ammonia being prevented by the addition of tartaric acid. Iron, which in the usual methods of assay is removed by precipitation and causes trouble by occluding some of the cobalt and nickel, is thus removed in a soluble form.

In applying this procedure to cobalt steel, it was at once found that the large amount of tartaric acid required to keep up the iron and chromium (10 grammes for 1 gramme of steel) retarded the complete precipitation of the cobalt sufficiently to render the process useless. An attempt was therefore made to remove the bulk of the iron by precipitation, and then complete the separation by the iodide process. Such a manipulation would still be preferable to the removal of the iron by one of the usual methods (e. g. as basic acetate).

The elimination of the bulk of the iron was satisfactorily accomplished by means of sodium carbonate, using thiocyanate as an external indicator. The filtrate was then evaporated to dryness with nitric acid, taken up with 2 to 3 grammes of tartaric acid, made strongly ammoniacal, and precipitated with potassium iodide (Method I).

The process now proved much more satisfactory than in its original form, and the figures obtained were mostly in close agreement; yet, on continuous testing, the results were rather erratic, the iodide precipitate sometimes crystallizing out slowly instead of forming instantaneous on adding the potassium iodide. After much investigation we came to the conclusion that cobalt is precipitated less readily from tartrate solutions than nickel; if the latter is present in sufficient proportion, it induces more rapid precipitation of the cobalt; if not, a minimum concentration of tartrates should be aimed at, and this in turn would depend on the quantity of trivalent metals, the precipitation of which must be prevented. Now the addition of 2 to 3 grammes of tartaric acid in the above procedure was necessitated by the presence of chro-

mium. The latter is precipitated by sodium carbonate only after the whole of the iron has been thrown down, and to attempt its removal at this stage would involve the risk of precipitating some of the cobalt, as no convenient spot test is available for detecting soluble chromium salts in a solution containing a highly colored iron compound.

The method was, therefore, further modified by eliminating the bulk of the chromium in the following manner: The filtrate from the iron precipitate was precipitated, hot, with caustic soda and bromine. The precipitate consisting of the higher oxides of cobalt, nickel and manganese, together with a little ferric hydroxide and a trace of chromium, was filtered from the solution containing sodium chromate, dissolved in hydrochloric acid, the solution evaporated to dryness, the residue taken up with a little tartaric acid, and precipitated with ammonia and iodide (Method II). As soon as this mode of working was adopted, the results became concordant.

The procedure in its improved form would seem somewhat complicated, but Method II is actually shorter than Method I in that it obviates the evaporation to dryness of the filtrate from the iron precipitate. It is considerably quicker than the basic acetate process, apart from the fact that the latter is ineffectual in presence of much chromium. For the further treatment of the iodide precipitate, several methods may be used. After dissolving the precipitate in hydrochloric acid, the cobalt may be thrown by nitroso- β -naphthol, or the nickel by dimethyl-glyoxime. In this investigation the authors have made use of their previously published method for the separate volumetric estimation of cobalt and nickel. Full directions for carrying out the process will be given below. As regards the time required for the determination, several assays can be completed in about three to four hours from the time the steel has been obtained in solution. The attack is usually rather protracted, several hours' boiling with aqua regia being required.

The material used in this investigation was kindly supplied by C. O. Bannister, to whom the results given in the table were submitted. Mr. Bannister is satisfied that these figures closely check those obtained by him by analysis. Sample H was assayed according to Method I, and the supply of material was exhausted before Method II was adopted. The latter was used on samples I to K.

Paper read before meeting of British Iron and Steel Institute.

Experiment	Sample	Cobalt per cent	Nickel per cent	Cobalt + Nickel per cent
106d	H	3.51	0.68	4.19
108e		3.54	0.63	4.17
108g		3.58	0.65	4.23
116a	i	3.21	0.55	3.76
116b		3.19	0.55	3.74
118a		3.27	0.41	3.68
119a	J	3.85	0.57	4.42
119b		3.87	0.57	4.44
122a		3.84	0.55	4.39
123a	K	3.62	0.62	4.24
124a		3.64	0.55	4.19
124b		3.67	0.55	4.22

Two grammes of drillings are weighed into a flask and treated with 30 c.c. each of strong hydrochloric and nitric acids. The assay is heated gradually at first, then boiled gently for four to six hours, and evaporated substantially to dryness over a free flame; 2 c.c. of sulphuric acid (1 : 1), a little hydrochloric acid, and 25 c.c. of water are added, and solution brought about by warming. The addition of the prescribed amount of sulphuric acid is essential for the success of the next operation, as it produces a pale brown pulverulent iron precipitate which is easily filtered off.

The cooled solution is diluted to 50 c.c. and precipitated with 20 per cent sodium carbonate solution added from a burette. When the iron begins to come down, a drop is withdrawn between the additions of carbonate and brought in contact with a drop of 10 per cent thiocyanate solution in a flat porcelain dish used as a spot plate. When the red coloration grows faint and becomes masked by the rust-brown precipitate, the spot tests are returned to the assay and the latter transferred to a graduated 200 c.c. flask. The volume is made up, the solution filtered through a pleated 12.5 cm. filter, and 100 c.c. pipetted into a 300 c.c. beaker. The liquor is brought to a boil with 1 to 2 c.c. of nitric acid and treated with 25 c.c. of bromine water and an excess of freshly made caustic soda. After boiling for a minute or so, the black precipitate is filtered off on loose paper (Whatman, No. 4, 9 cm.) and washed with boiling water. It contains all the cobalt and nickel, together with small quantities of iron, chromium and manganese, and its subsequent treatment does not differ from that previously published, except that a colorimetric manganese determination is necessary in the titrated cobalt solution. The whole procedure, partly quoted from our two papers already referred to, is hereunder described in extenso.

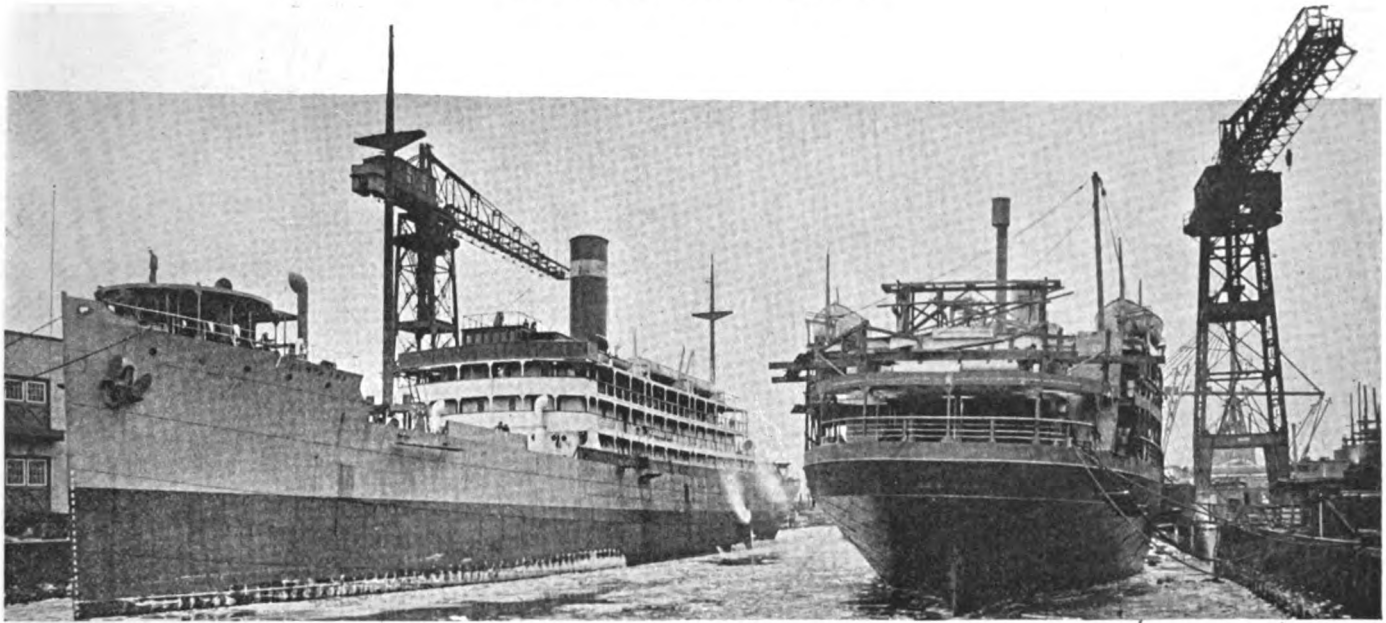
The precipitate is rinsed back into the beaker, dissolved in a little hydrochloric acid poured over the filter, the solution transferred to a flask, and evaporated almost to dryness over a free flame. It is again evaporated with 2 c.c. of strong nitric acid to destroy the bulk of the chlorides. A cold saturated solution of 1 gramme tartaric acid is now added, then 50 to 60 c.c. of strong ammonia (0.88 sp. gravity), followed immediately by a cold saturated solution of 4 grammes potassium iodide. A pale pink crystalline precipitate

is at once thrown down. After settling for 15 minutes, it is filtered off on a loose 9 cm. filter, and washed with ammoniacal iodide solution (strong ammonia 200, water 50 c.c., potassium iodide 10 grammes) from a wash-bottle fitted with a Bunsen valve.

The iodide precipitate (containing only cobalt and nickel with a little manganese) is dissolved in 10 c.c. of hydrochloric acid (1 : 1) and a little sodium sulphite poured through the filter into a 300 c.c. beaker; the washing is done with hot water; 5 c.c. of 25 per cent ammonium phosphate solution are added, the liquor heated to boiling, and treated with ammonia (1 : 1), added, finally drop by drop with continual stirring, until the blue amorphous precipitate at first produced becomes pink and crystalline. An excess of five drops of ammonia is then added and the assay left to stand on a steam bath for 10 minutes; on account of the small quantity of nickel present, a reprecipitation is unnecessary.

The pink precipitate of cobalt ammonium phosphate is filtered on a loose 9 cm. paper and well washed with hot water. The filter is spread against the side of the beaker, rinsed down with water, followed by a few drops of the N/5 acid used in the titration and again with water to displace the acid, taking care not to use more than about 30 c.c. in all. The filter is now discarded, and the gradual addition of acid continued until the precipitate disappears. No indicator is required, for the precipitate imparts a lilac color to the liquid, while its final disappearance can be ascertained with 0.1 c.c. In order to determine the manganese (which is precipitated with the cobalt as manganese ammonium phosphate) the above titration must be carried out with N/5 sulphuric or nitric, but not hydrochloric, acid. The titrated liquid is filtered (to free it from filter fibers) into a 100 c.c. graduated flask; 10 or 20 c.c. are pipetted off, boiled with persulphate and silver nitrate in the usual manner, and the color matched against that of a standard solution containing 0.072 gramme of potassium permanganate per 500 c.c. (1 c.c. = 0.05 milligramme manganese); 1 to 3 milligrammes of manganese are thus found. The acid consumed by the manganese ammonium phosphate (0.18 c.c. per milligramme of manganese) is subtracted from the volume found, the difference giving the cobalt (1 c.c. of N/5 acid = 0.0059 gramme of cobalt).

The filtrate from the cobalt ammonium phosphate is cooled and titrated from a solution containing 10 grammes of sodium cyanide, 2 grammes of caustic soda, and 1 gramme of silver nitrate per liter. The quantity of nickel being very small, the assay is left to stand for a few minutes after about 1 c.c. of cyanide solution has been added, when the cloudiness due to silver iodide becomes visible. The addition of cyanide is then continued drop by drop, while shaking, until the liquid clears. The cyanide solution is standardized every week against pure nickel or silver.



Committee on Public Information.

Plate Production Expedites Shipbuilding

Rolling Mill Capacities Increased Twenty Per Cent and Material Saved by Efficient Plate Specifications — Many New Plate Mills Built — Description of Liberty Mill of Carnegie Steel Company.

By ALFRED M. STAEHLE.

The story of the great progress made in the United States shipbuilding program, which has placed this country among the leaders, if not in the position of the leader, of marine shipbuilding nations, is closely associated with the efficient method of plate production established at the beginning of the program. The fabricated ship was the source of astonishment and admiration to a Lloyds inspector acquainted with British shipyard methods during a recent visit at an American shipyard. He viewed plates cut and punched before reaching the yard being assembled without the slightest difficulty or waste of time in fitting. The American bridge templet method had been and is being applied to shipbuilding methods.

Plate orders for shipbuilding are planned to insure maximum production for rolling mill operations. To effect this end it was found desirable that shipbuilding practice conform to uses established as standard in the fabrications of shapes and plates for bridges. Useless and minute variations in the thickness of plates are absolutely eliminated. This latter step led to decided advancement over British practice. British practice calls for plates varying in thickness of $1/50$ of an inch. Thus if a plate failed to pass standard tests such as tensile strength, the plate not being in a suitable thickness for bridge, car, building or other work had to be scrapped. In this country plates vary in thickness in multiples of standard fractions as $1/32$ inch. A plate failing to pass specifications can therefore be used on some other order having lower tensile stress require-

ments. The saving in steel is obvious. Rolling mill capacities have also been increased due to the fact that less adjustment on the mill is required. It is estimated on good authority that the advantage of this method has increased plate rolling mill capacities 20 per cent.

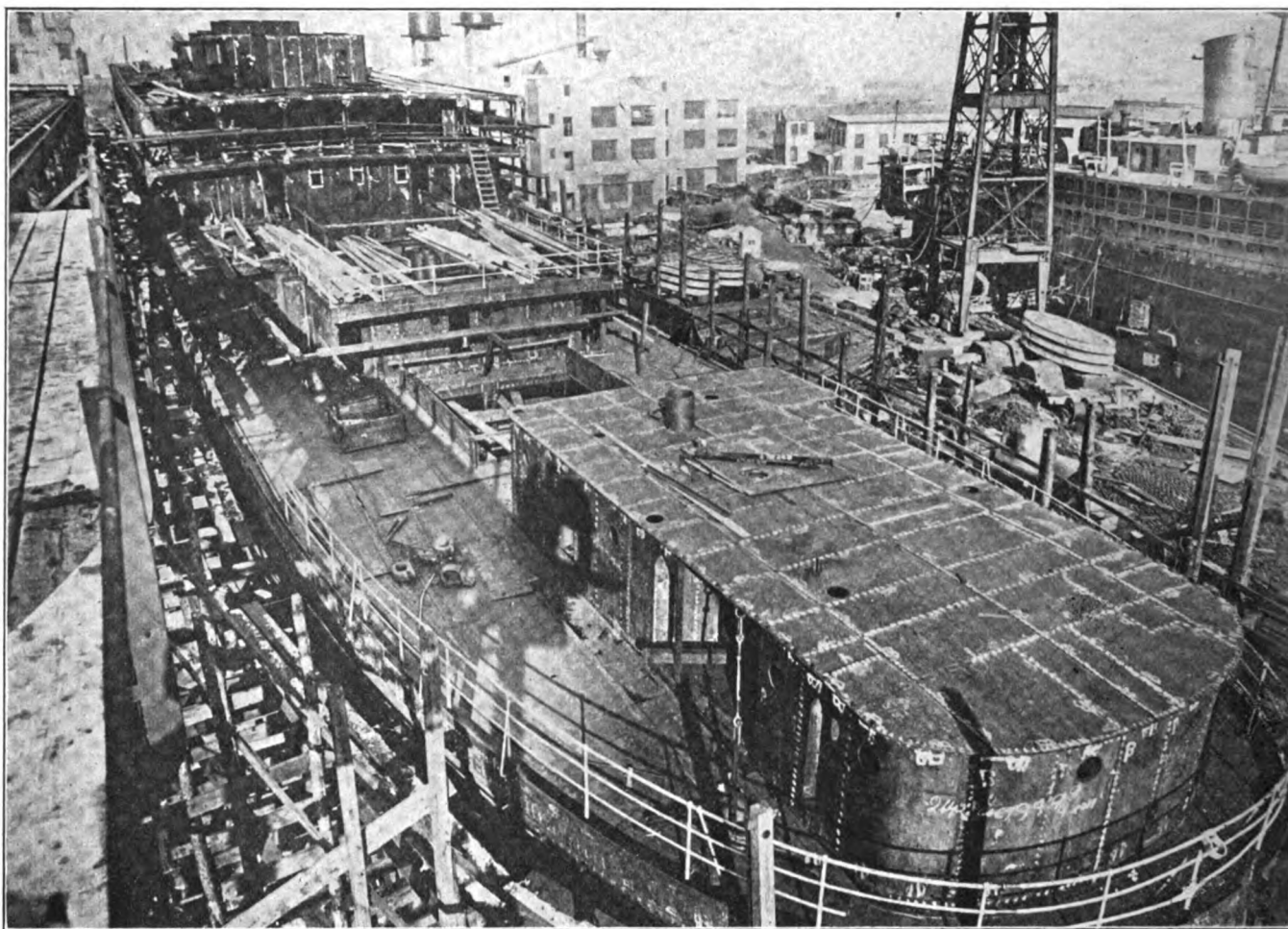
The United States Shipping Board some time ago recommended that effective immediately and retroactive so far as possible the following be the basis on which sizes shall be specified on drawings and orders accepted from shipbuilders for steel for cargo and other vessels, exclusive of ships for the United States Navy:

1—*Structural Shapes*. That shapes be specified on drawings and mill orders only to the published weights or dimensions and that to relieve the present congestion the use of tees and deck beams be eliminated to the greatest extent possible, also that structural channels or angles be used for ship channels or bulb angles; provided, however, that ship channels and bulb angles may be rolled if required by shipbuilders' schedules.

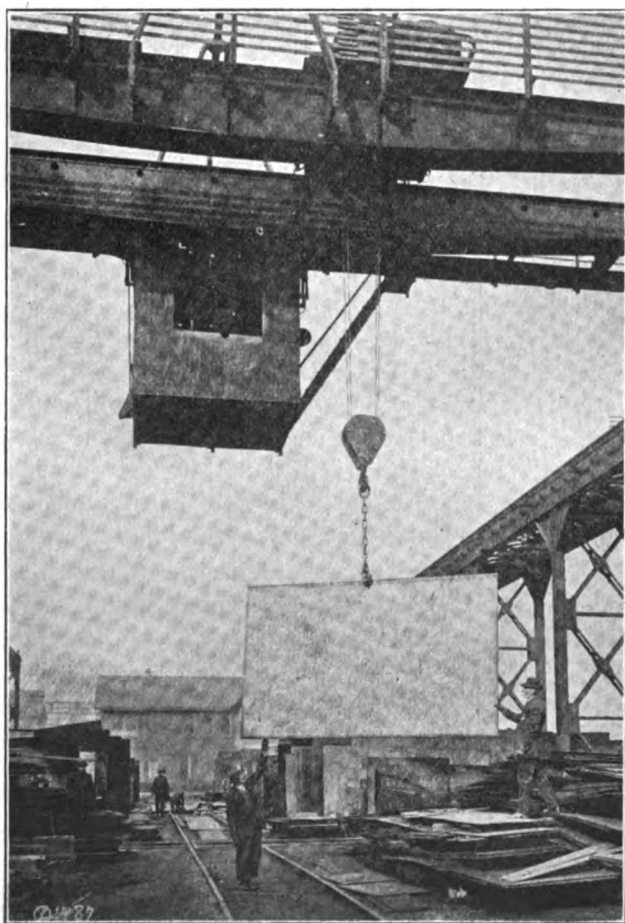
2—*Plates*. That plates be specified on drawings and mill orders to fractional thicknesses, and that thicknesses be in multiples of $1/16$ inch and $1/32$ inch where necessary.

3—*Sketch Plates*. That sketch plates be ordered in multiple and cut to size at the shipyard, rolling mills to furnish to sketch only straight double or single taper plates.

4—*Universal Mill Plates*. That within universal plate mill limits plates be furnished sheared or universal



These interesting illustrations secured through the courtesy of the Committee on Public Information show, above, steel merchant ship in an eastern yard nearing completion. This gives an idea of the great amount of plates necessary—Lower view shows plate being hoisted into position for marking of rivet holes.



at mills' option. Where sheared plates are absolutely necessary, orders should be marked "sheared only."

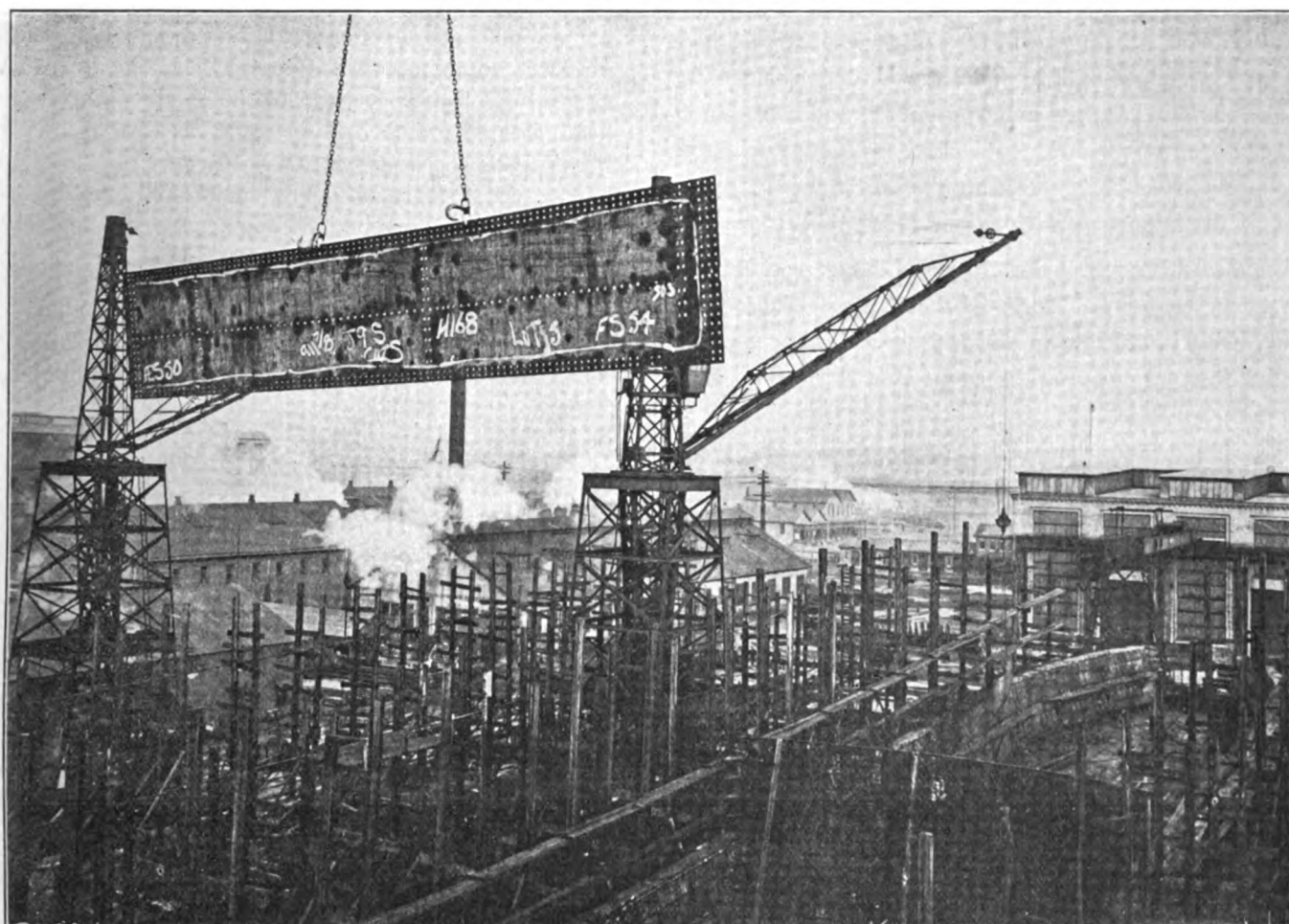
5—*Short Lengths.* Plates, shapes and bars three feet long and shorter should be ordered in multiple lengths. To assist mills, orders should specify lengths into which multiples are to be cut so as to permit, at mills' option, application of short length pieces.

6—*Multiple Widths.* Plates narrower than 18 inches (preferably 24 inches) and lighter than $\frac{1}{4}$ inch should be ordered in multiple widths, to be re-cut to widths at the shipyards, and to assist mills, orders should specify widths into which multiples are to be cut so as to permit, at mills' option, application of narrow width plates.

7—*Extreme Sizes.* Extreme sizes of plates, as shown in makers' published lists, both as to widths and lengths should be avoided. The rolling of such extreme sizes reduces the output of the mills.

8—*Plates for Flanging.* For flanging that is to be done on ship steel to these specifications, orders should be plainly marked "For Flanging."

9—*Specifications for Quality.* That the steel be manufactured in accordance with requirements of the American Bureau of Shipping or Lloyd's Register of Shipping or to specifications A-12-16 of the American Society of Testing Materials as may be called for by ship-



Here a mammoth plate, cut and punched, is being hoisted into position to be bolted to ship frame and then riveted. The illustration also shows the heavy demands that have been made on crane manufacturers—Below heel plates are being assembled for a freighter.

builders' schedules and subject to testing and inspection at the mill.

10—Marking. In addition to stamping required by above specifications and classification inspections, mills to mark material only with hull number and item number, when shipbuilders' schedules call for this system of marking.

11—Beams, Channels and Angles Recommended for Ships:

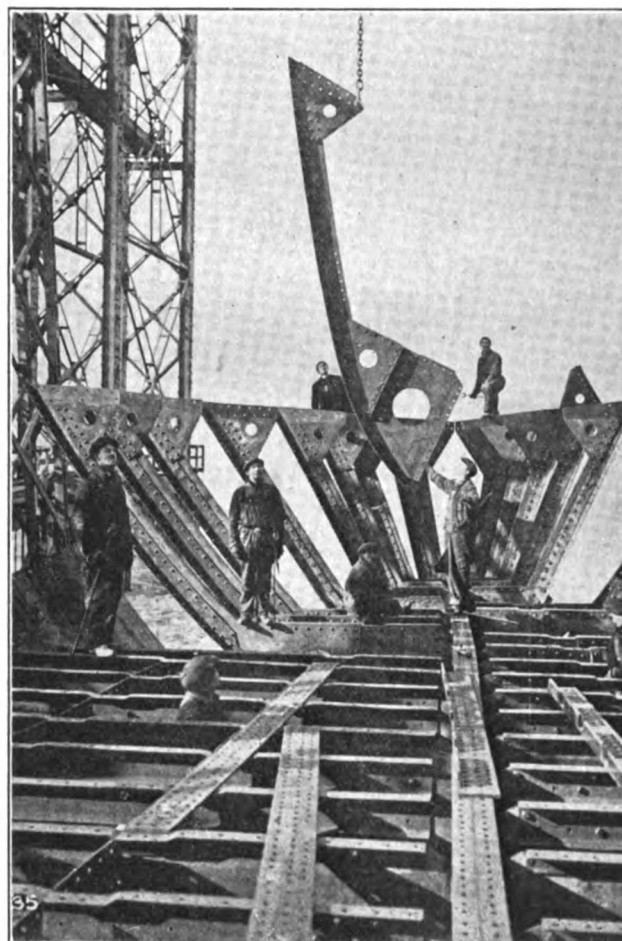
American Standard Beam Sections—American Standard Structural Channels—Angles.

(Dimensions in Inches)

8 x 8 x $\frac{1}{2}$ to $1\frac{1}{8}$	6 x $3\frac{1}{2}$ x $\frac{3}{8}$ to $\frac{7}{8}$
6 x 6 x $\frac{3}{8}$ to 1	5 x $3\frac{1}{2}$ x $\frac{5}{16}$ to $\frac{3}{4}$
4 x 4 x $\frac{5}{16}$ to $\frac{3}{4}$	5 x 3 x $\frac{5}{16}$ to $\frac{11}{16}$
$3\frac{1}{2}$ x $3\frac{1}{2}$ x $\frac{5}{16}$ to $\frac{5}{8}$	4 x 3 x $\frac{5}{16}$ to $\frac{5}{8}$
3 x 3 x $\frac{1}{4}$ to $\frac{1}{2}$	$3\frac{1}{2}$ x 3 x $\frac{5}{16}$ to $\frac{9}{16}$
$2\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{1}{4}$ to $\frac{7}{16}$	$3\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{1}{4}$ to $\frac{1}{2}$
7 x $3\frac{1}{2}$ x $\frac{3}{8}$ to 1	3 x $2\frac{1}{2}$ x $\frac{1}{4}$ to $\frac{7}{16}$
6 x 4 x $\frac{3}{8}$ to $\frac{7}{8}$	$2\frac{1}{2}$ x 2 x $\frac{1}{4}$ to $\frac{3}{8}$

Steel specifications are based on the standard specifications for structural steel for ships as adopted by the American Society for Testing Materials in 1901 and revised to 1916.

The great demand for plates has of course greatly increased the plate rolling capacity of the country. Steel mills have been busy installing new plate mills. An interesting description of a new plate mill appeared in THE BLAST FURNACE AND STEEL PLANT in the July issue, concern-



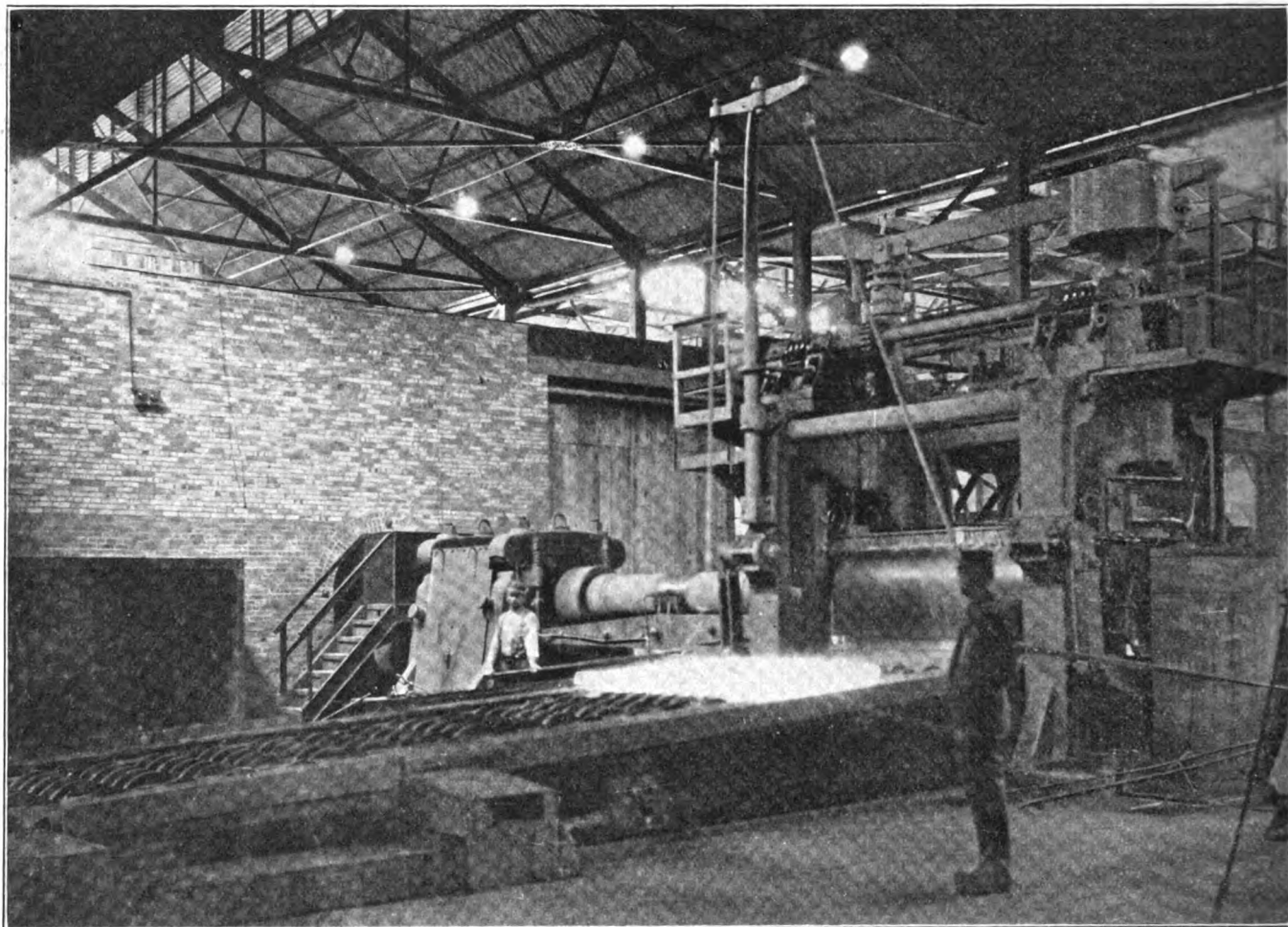
ing the Youngstown Sheet & Tube installation. The mammoth Lukens mill, built by the United Engineering & Foundry Co., caused much attention, and a new mill to be started at the Brier Hill plant at Youngstown will also prove of interest. These mills are, however, just a few of the important installations mentioned in passing.

The construction of the 110-inch Liberty plate mill by the Homestead Steel Works of the Carnegie Steel Company, in six months, is an engineering achievement which justly deserves mention in connection with this short

by 66-inch stroke Snow twin tandem gas engine directly connected to a General Electric 3,750 KVA generator. Power is transmitted to the mill on overhead lines carried on poles. This line spans the Monongahela River on two towers 115 feet high having 301-foot bases. The main mill motor takes current at the original voltage. At the subsidiary motors the voltage is reduced to 220.

Rolling Mill Machinery.

The mill itself is a three-high plate mill with 110-inches length of roll body. Top and bottom rolls are



110-inch Liberty mill turning out record tonnage.

sketch, showing the relation between plate production and the shipbuilding program.

This mill is the first electrically driven plate mill to be operated by the Carnegie Steel Company. It is entirely electrically driven from start to finish. The main motor is a 4,000 horsepower General Electric motor. The crane motors, table motors, shear motors, motors for driving pumps, etc., were built by the Westinghouse Electric & Manufacturing Co.

The power furnished is alternating current, 3 phase, 25 cycle, 6,600 volts, developed at a central power station at Carrie Furnace by a 46-inch bore

36 inches in diameter, middle roll 21 inches. The rolls are chilled iron and were made by the United Engineering & Foundry Co., of Pittsburgh.

The mill was designed by Homestead Steel Works and built jointly by Mackintosh, Hemphill & Co., and the Mesta Machine Company, Pittsburgh. Mackintosh-Hemphill made the mill, large castings for charging machines and cranes, including mill housing. Machining was done by Homestead Steel Works. Mesta Machine Company made the pinions, the pinion housing, the pinion shoes and the mill shoes. The practice on motor driven mills has been to use machine cut pinions; they were

machine moulded and operate as noiselessly as any cut gears.

The mill is served by seven cranes and two over-head traveling charging machines; namely—

- 1—15-ton crane in slab yard.
- 1—50-ton crane in mill building.
- 3—10-ton double trolley cranes in shipping building.
- 2—10-ton single trolley cranes in shear building.
- 2—10-ton charging machines in heating furnaces building.

All these cranes and their equipment were made by Homestead Steel Works itself. There are three main shears, two side shears with 144-inch knife and an end



Straightening rolls and cooling tables, Liberty mill.

shear with 110-inch blade, all made by the Morgan Engineering Company Alliance, O. The two scrap shears were made by the Cleveland Punch & Shear Works. The straightening rolls were made by the R. S. Newbold & Son Co., Norristown, Pa., and consist of a machine with nine rolls, 14 inches in diameter and 116 inches long. The roll tables were made by Homestead Steel Works.

Heating Furnaces.

The heating furnace building, houses eight regenerative heating furnaces. This is an unusually large number for a plate mill which can generally reach its maximum rolling capacity with four or six. Extra heating furnaces were provided to care for unforeseen contingencies due to the use of cold slabs. At present furnaces are heated with natural gas. They may be heated with either natural gas, oil or tar. Ultimately when the full schedule of improvements is completed, the method of heating will be by by-product gas from the Clairton coke ovens in conjunction with a small quantity of tar.

Production.

The mill rolls plates up to 100 inches wide and from 3/16 up to 2 inches thick. It rolls from slabs and sufficient steel for it is not available at present from the Homestead furnaces. The slabs come from Farrell Steel

Works and Furnaces, Ohio Steel Works and Furnaces and Donora Steel Works and Furnaces, with a few slabs from the present Homestead slabbing mills.

The Liberty mill was originally built to roll 16,000 tons per month. Below is the record for this year to date:

	Monthly Tonnage
January	13,951
February	13,375
March	17,240
April	18,025
May	20,973
June	18,433
July	17,678

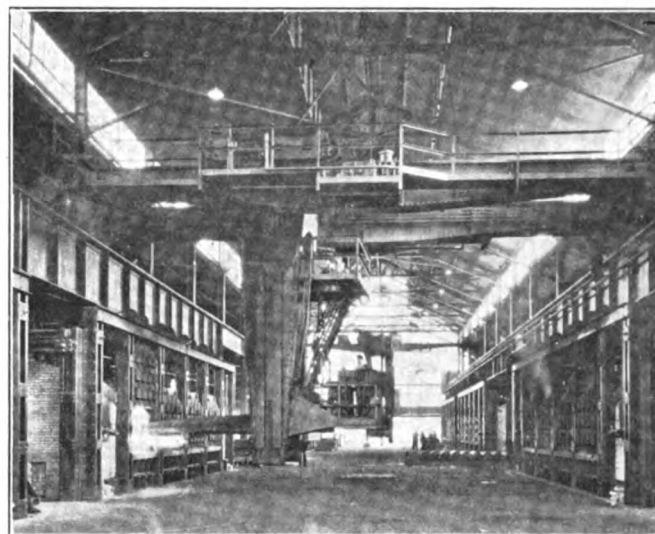
Fuel for Future Ships.

There is much that can be said concerning the ship-building industry which is of great interest. A prediction made by Edward N. Hurley concerning the fuel problem for the future merchant marine is of worthy note. We quote Mr. Hurley:

An improvement in our new merchant marine that will mean much in better operation, better seamen and better morale is the substitution of fuel oil for coal. We expect to put 400 oil-burning ships on the ocean this year.

Tonnage Built This Year.

The following figures show the remarkable progress which is being made in the bridging of the seas by this country. The figures show actual launchings:



Charging machine and reheating furnaces, Liberty mill.

Month.	Deadweight Tons
January	88,507
February	132,625
March	172,611
April	160,286
May	259,241
June	283,322
July	631,944
Total	1,719,536

In preparing data for this article the author wishes to acknowledge assistance given him by R. B. Woodworth, of the Carnegie Steel Company.

Conserving Manganese in Steel Production

Scarcity of High Grade Ore Due to Import Restrictions
Forces Substitution of Lower Grade Ores and Consequent Change
in Production Methods—Practical Points for Saving Manganese.

By A. N. DIEHL.

The problem of manganese conservation divides itself automatically in two parts, namely; preparing the ferroalloys to the best advantage of the available ore supply, and consuming the alloys to the best economic advantage, with regard to the proportionate supply, and adequate practice supervision.

In the United States manganese ore is scattered. It is found generally in pockets causing irregular production. No small proportion is high in phosphorus content. Any low phosphorus ore containing six to one ratio between iron and manganese with a content of 40 per cent iron or over, might be considered as a source of recarburizing manganese. Mixtures of such lower grade ores with higher ones can be varied to produce any predetermined alloy, depending on the metallic ratios. A study of this phase after a canvass of the deposits might be made to determine if any grade between the commonly called ferromanganese and spiegel grades would be desirable.

Since manganese alloys with iron in practically all proportions, the terms manganiferous pig iron, spiegel and ferromanganese are merely arbitrary trade demarcations, but on account of their specific uses, have been often considered as alloys having different inherent qualities.

The production of 80 per cent ferromanganese requires ore of high metallic content, which is mostly imported. Transportation conditions make it absolutely necessary to use such cargoes to the best advantage by mixing with our native production in such manner as to make the greatest quantity of the latter available as an alloy. This will result in the application of lower alloys than those to which we have been accustomed. The application of the spiegel cupola practice, principally for low grade alloys, is extremely flexible, and a manufacturer of high carbon steel, especially in quantity, should consider such installation carefully. In most cupola practice, the alloy is diluted with pig iron to 5 or 6 per cent of manganese, depending on carbon and manganese specifications. A 16 per cent alloy cannot be used in open hearth practice for carbon below 0.25 to 0.30 per cent and a portion of it will, at least, have to be melted or charged in the furnace.

From a discussion written by the author and read in connection with paper by C. R. Ellicott, before the American Iron and Steel Institute.

Manganese is introduced in the steel in several different ways:

1—In the ladle cold, or heated as is generally done in the Bessemer process with a loss of 20 to 25 per cent.

2—In the open hearth furnace, where it is melted with the bath and having an accompanying loss of 50 per cent.

3—As a combination of the two former methods where conditions are heavy with an average loss of approximately 50 per cent.

4—In the molten condition introduced into the ladle with a loss of 15 to 20 per cent in spiegel and 20 per cent loss in ferro, or as in manganiferous pig iron recarburization where it is poured through the furnace, showing a loss of 25 to 30 per cent. Such manganese should be considered as constituent of the iron rather than in the recarburizer class.

The chemical range of the carbon content, in the iron manganese alloy of 95 to 2, and 12 to 80 proportion, is approximately from 3.75 to 6.50 per cent, increasing gradually through the different ranges with slight variation, due to the other metalloids. As the carbon range is thus comparatively small, the manganese content is the principal factor determining which should be the proper alloy to use.

As long as 80 per cent ferro was available, the cold, ladle addition was the most economic course to pursue, and should be utilized to the fullest extent with the more diluted grades. Cold ladle additions up to 30 pounds per ton, should not be excessive. We have used 40 pounds per ton in 60-ton heats at a number of plants. Care in heat manipulation, however, is necessary in such cases. Obviously, the carbon requirement will be the determining factor. The Carnegie Steel Company, as well as other subsidiaries of the United States Steel Corporation, for a considerable period have been using 60 per cent ferro as a substitute for the 80 per cent grade with equally good results. The only change noticed was a slight raise in the carbon limits, the low practical limit being about 0.12 per cent carbon. With a 50 per cent grade, making 0.50 per cent manganese steel, the carbon low limit would be about 0.16 per cent. All higher carbon or manganese specifications can be met without difficulty. The United States Steel Corporation has changed its spiegel grade to 16 per cent manganese with a prospect of still further reduction.

However, the greatest real conservation will be centered in the judgment and activity of the operator. He must appreciate the urgency and expediency

cy of such effort. It might be well to add a few reminders in the form of "Do Nots" which while well known, are sometimes overlooked. They may serve either to close an avenue of loss, or as an idea inspiring additional investigation.

Do not, as an industry, retard your quality or quantity to any appreciable extent.

Do not forget that the foreign supply of manganese ore is largely embargoed, and water transportation almost prohibitive, and also that steel, up to the present date, cannot be made without manganese.

Do not overlook the fact that there are some low manganese deposits in this country which must be utilized to increase the available supply necessary to carry on full operations.

Do not, as a manufacturer of manganese alloy, allow any wastage of metallic content beyond what is absolutely necessary, and keep the percentage of fines to a minimum. Large lumps will sink into the bath while the fines will often be lost in the slag. Keep alloy away from moisture. Be careful to keep grades separated and ores properly analyzed, and mixed for specific grades.

Do not, as a manganese alloy consumer, allow melters and helpers to cover bad melting practice by large additions of manganese to restore overoxidized conditions in the furnace. Proper attention to the melting of heats will save both manganese and money.

Do not use high grade alloy when a lower will suffice, as in our native supply, the low grade ore is greatly predominant. Melting the recarburizer and pouring direct into the ladle, thereby being able to use a low alloy, should be done wherever justifiable and practicable. Also do not waste high manganese scrap or slag having the proper chemical contents for recovery. The scrap can be used in spiegel cupolas.

Do not put any alloy into the furnace direct, until the maximum of cold ladle additions are made. Pre-heat if deemed advisable. Authorities differ as to this, but we may assist in solving the controversy.

Some few specifications will require a washing, and others excessive amounts of manganese, which must be furnace additions, but the most conservative methods should be applied in accomplishing the purpose.

Do not overlook the manganese in pig iron when it can be used to recarburize, as its manganese can be of great use, especially in high-carbon, low-manganese specifications, also high-manganese iron will give three to five points more residual than a lower one, thus making available a supply otherwise wasted, as this manganese could not be considered under the recarburizer grade.

Do not forget that high carbon heats caught "coming down" will retain a high residual manganese if a 50-50 iron and scrap charge and no run-off slag is used; 0.20 to 0.25 per cent may be saved in many cases. With a run-off slag, the manganese is mostly lost.

Do not, as a steel consumer, insist on a maximum manganese specification if one of lesser chemistry is equally applicable, and possible of performing the same duty. The steel manufacturer must still meet the requirements and will not go beyond a point where the product may be affected, also some of the native ores contain considerable phosphorus, and a high limit to 0.06 or 0.07 in open hearth and a few points in Bessemer steel will not affect a hardship in many cases, especially in material where a little risk is encountered.

These "do nots" may outline a few of the ways saving might be effected. They are offered, not as a manufacturer's request, but as an urgent call for a general manganese conservation rally. The subject is of sufficient importance to justify every manufacturer or consumer to be equally concerned, and aid by every possible means the conservation of this necessary element, as well as to make available a portion of our native resources, for which we have heretofore been dependent on other nations.

Practical Pointers on Wire Rod Rolls

Consideration of Design of Passes and Roll Trains—Draft Influenced by Form of Pass, Structure of Metal and Degree of Heat.

By W. S. STANDIFORD.

The war has created a great demand for barbed wire, as it has been found out by experience on the battle fields that when wire entanglements are used in front of trenches, that fewer men are needed to hold the trench against enemy attacks. As the basis for wire is wire rods, the designs of the roll passes and the difficulties encountered in the manufacture of the rods will, undoubtedly, be interesting to the readers of this magazine.

Most mill managers and others who are not in any degree familiar with the principles upon which roll passes are constructed, or who have no theoretical or practical knowledge of roll designing, seem to have

an idea that all that is necessary in the designing of rolls, is to turn a series of passes in the rolls having the form of the finished bar. A trial of such passes for producing the common round or square would demonstrate some of the elementary principles of roll design namely: That rolls can only reduce metal in a line angular to their axis; that the general direction of one or both of the surfaces of the rolls between which the reduction takes place must be angular to the plane of rotation; and that passes do not lessen the dimensions of the bar which is parallel to the axis of the rolls, but in all cases increase it more or less. For the latter reason, when the section is wider

than the pass, the metal extending between its sides is not pressed into the body of the section, but is pinched out between the collars forming the sides of the pass and makes a thin rib along the side of the

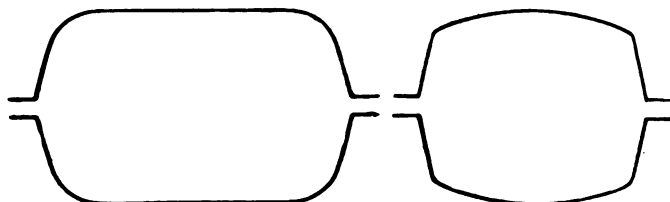


Fig. 1.

Fig. 2.

bar, which is technically called "a fin." All mechanical design is a compromise in parts to secure the best general result as a whole. So it is in roll designing.

Passes are modified in their form and details in view of their relation to each other and to the layout of their train, its capabilities and the character of the work they are required to do. The ordinary diamond passes, while excellent for some classes of work, have been found by experience to be far too slow for use in rolling wire rods, as they allowed the rods to cool very quickly. With the demand for small sized rods, a quicker and more effective form of pass became a necessity, the result being the adoption of a series of alternate oval and square passes, which proved to be very efficient and also more rapid as they have a draft equal to two or three times that of the diamond pass. There are few forms of passes in which the section reduces evenly; that is to say, where the draft is proportioned to the thickness of the section in all its parts. The length of a bar increases as the area of its cross-section decreases, and as the increase in length must be co-extensive in all parts of the section, it follows that if one part is subjected to a heavier draft than another, the metal must flow into that part having the least.

The form of the pass, the more or less perfect physical structure of the metal, and the degree of heat are the important factors in determining the draft in passes for wire rods and small sections. We can deduce from the above principles, that with a high temperature, a radical change in section as from a square to an oval may be attended with considerable reduction in sectional area; while low temperatures render such a change in section impossible, and as the temperature lowers, the sectional change and drafts must be modified.

From the above facts, it is essential in designing passes for this kind of work, not only to decrease the drafts, but to make the ovals thinner and wider as they decrease in size. In designing rolls, it is the custom of roll designers to make the rolls of such a diameter as to allow sufficient strength to prevent breakage, but the diameters of the rolls are usually

out of all proportion to that necessary for strength, particularly in the case of the smaller passes for wire rods. It is difficult to state in a general rule just what amounts of draft could be put into a square or oval, but it can be ascertained by taking the mean of a series of passes and formulating a rule therefore and apportioning the drafts in the others according to the conditions of the train of rolls, which differ more or less in every mill. Taking the average grade of low carbon steel, the maximum draft on a 3-inch square billet is about 75 per cent; while on the smallest square in the series (in the finishing oval) not more than 15 per cent is allowable. The wide difference in the grades of metal rolled makes an arbitrary rule of roll drafting impracticable, if not impossible. These conditions vary in themselves. Some trains are constructed in which the diameters and length of the rolls are adapted to the passes that are to go in them and which are capable of resisting the stresses of the heaviest drafts that can be put upon them. In some other roll trains, the passes and drafts have to be modified, depending on the engine power, thickness of rolls and the quality of metal rolled. Thus a low carbon steel can be reduced 15 to 20 per cent faster than the softer grades of iron. On the other hand, tool steel which can only be heated moderately, cannot be subjected to a heavy draft, because a heavy reduction in section when the metal begins to set and the flow ceases, will injure the metal and most likely break rolls.

The standard size of billets as used in the average wire rod mill is 4 by 4 inches square, their weight ranging from 100 to 200 pounds. Eighteen passes are generally used to reduce the 4 by 4-inch billet down to a number six-rod (Birmingham wire gage) which is .209 thousands of an inch. The longest series of

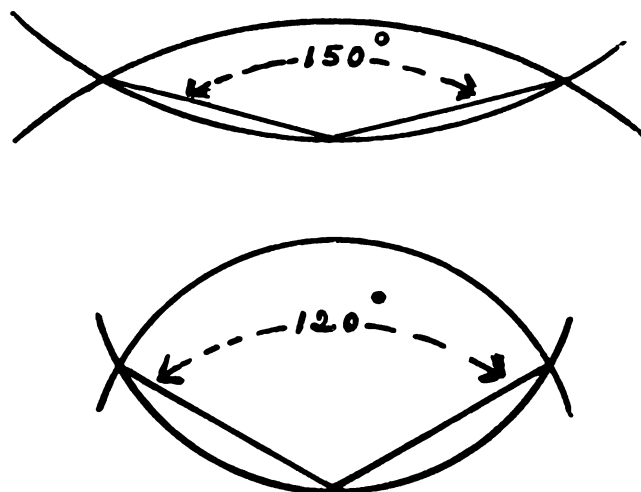


Fig. 3.

alternate square and oval passes are those used in wire rod manufacture. As from three to eight rods are rolled at one time, using alternate square and oval passes, it is necessary to have a number of du-

plicate grooves in the rolls, so that when one wears out another pass can be used. An oval pass could be used for the first pass, but the rolls would be unnecessarily large in diameter for those preceding it. By using 18 passes to reduce the 4 by 4-inch billets, the draft in the first two passes may be modified, so that smaller rolls can be used. These rolls as a rule are 18-inch pitch diameter. As the modified draft in the first two passes is not enough to use an oval to advantage, a change in the form of these passes is necessary. The form adopted in most mills for the first two grooves, are box and edging passes. As the billet comes from the furnace, it is at its highest temperature and will allow of considerable reduction in the box pass shown in Fig. 1. Box passes reduce the billet mostly on the top and bottom, there being very little work done on the sides. In order to allow the billet to go through the groove easily, it is necessary in designing these passes to make the sides tapering, allowing the billet to fit snugly at the bottom. If the sides of the groove were made straight the billet would be torn at joints of the rolls, and spread out between the collars and would break the rolls. The tight fit of the billet at the bottom prevents the billet from turning over in the pass and jamming the rolls. The use of large fillets in the bottoms of both box and edging passes insures that the corners of the billet are worked equally, which makes the metal fibrous in character. As the billet has had only two of its sides reduced in the box pass, it is turned over at a right angle to its previous position in the box pass and inserted edgewise in the edging pass shown in Fig. 2 which squares the billet up, making it $2\frac{3}{4}$ inches in size and ready for the alternate oval and square passes. The oval used for roughing passes is constructed geometrically by the intersection of two circles of equal diameter, depicted in Fig. 3. Lines drawn from the points of intersection of the circles to the centers, are the angles of the oval. The length of the line subtending the points of the intersection—the chord of the arcs—is called the width; and the sum of the two radii less the distance between the centers of the intersecting circles, is the thickness.

It is plain that as the centers of the angles approach each other, the oval becomes relatively thinner and that the angles and the number of degrees in the arcs increase. Fig. 3 illustrates ovals having different angles of 120 and 150 degrees of arcs. An oval is used between two squares, and by its proportionate width to thickness, it is made capable of heavy or light draft and a greater or less allowance for spread in both the oval itself and the square. The draft in an oval varies inversely as the number of degrees contained in the arc. In even figures, an oval having an area between 1 and $1\frac{1}{2}$ square inches, and having an angle of 150 degrees, will reduce a low carbon

steel billet 80 per cent. And an oval having an angle of 120 degrees will reduce a billet 50 per cent. The percentage of drafts in oval and square passes used in rolling wire rods must be decreased as the rod cools through the successive passes and is reduced in size. The relative width and thickness of an oval not only affects its own draft, but the draft in the square following in like proportion, for the reason that the thin oval allows itself greater speed in the square and it will, therefore, stand considerable reductions in sectional area before the square is filled out. The drafts in the first two passes in the roughing rolls are modified for the reasons given in this article, and the last two passes in the series are not depended upon for reduction, but merely to round up the rod from the last square which is usually the same size as the diameter of the round. This leaves 14 passes, seven ovals and seven squares, in which the draft must be distributed to reduce the billet delivered from the first two passes to a square equal in size to that of the finished round.

A series of passes showing the drafts used will be shown in the next article of this series. In passes designed for wire rod mills, the drafts in the smaller passes are made very light, principally to avoid making large loops between the passes, also partly on account of the large diameters of the rolls in the finishing trains, which causes the rod to spread more. The general practice is to use rolls from 10 to $12\frac{1}{4}$ inches diameter for the last eight passes to gain speed in the delivery and strength in rolls long enough to contain a sufficient number of grooves to run a considerable time without changing rolls. These diameters of rolls are out of proportion to the size of the rod which causes the latter to draw less and spread more than if the rolls were smaller in diameter, which have less and a sharper contact with the rod. The great disparity in draft between the largest and smallest oval illustrates this point. The diameters of each set of rolls also require to be so proportioned so that one set of rolls will not draw the metal faster than another set, as in this case the roll would be stretched (it being reduced in two sets of rolls simultaneously). When a rod is stretched, its sectional area is reduced correspondingly, which would be advantageous if it were uniform throughout its length, but as the stretching takes place in the middle of the rod, it causes a variation in its size when finished; the middle portion being smaller than the ends. If the square is stretched, the rod will be more or less scant in size when finished in that part of the length. If the oval is stretched, it will be scant, and if to an unusual extent it will not fill out the square pass it is entering, the result being that it will turn over in the pass, and should the rolls happen to be running close together a fin will be formed that will mark and spoil the rod.

Members of A. I. S. E. E. in U. S. Service

Information Concerning the Members of the Association of Iron and Steel Electrical Engineers, Whose Service Flag Shows Twenty-seven Stars, Eighteen of Which are Commissioned Officers

There is only one vital interest to every American to-day. The war and its allied problems make all others pass into mere insignificance. We are to-day chiefly interested in the production of the machinery of war, and in the personnel of the organizations which produce and use this machinery. The annual meeting of the Association of Iron and Steel Electrical Engineers, to be held this month, will, however, remind us that sometimes the producer may become the user. There will be missing faces at this convention. Some men who formerly met to discuss the problems of

the most important industry of the war have gone. Most of them temporarily. An attempt has been made, in the following article, to present detailed information concerning the members of the honor roll of this association. The personal experiences of these men and the great work they are doing, in nearly every branch of the government service, is a tribute both to themselves and to the A. I. S. E. E., which association in being so actively represented, by its members in both war and industry, is rendering the country a double service.

The purpose of this article is explained above. An attempt has been made, first to make a complete list of all men of the A. I. S. E. E. in the government service and to present information concerning their past firm connections, military training, present location and activities. In some cases very interesting extracts are published from letters written by these men. In most cases photographs have been secured. We are reasonably certain that the information concerning these men is correct up to August 15. We are not certain that this list is complete, although an exhaustive search has revealed no names which are not herein presented. The names are arranged in alphabetical order. We wish to take this opportunity to thank the friends and relatives who have co-operated with us and made this article possible.

J. H. Albrecht, Private—Now in the radio school, signal corps, College Park, Md. This being an officers' school, he is daily expecting a commission. Before entering the radio school, he took a 13 weeks' course in radio work at the University of Pittsburgh. Mr. Albrecht is a graduate of the electrical engineering department of the University of Michigan, class of 1910. After leaving school he took the apprentice course at the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. During the past three years he has been a salesman in the electric control department of the Westinghouse company. His letters speak very enthusiastically of the care given the men at the training camp.

James M. Andrews, Colonel—Col. James M. Andrews, well known in the iron and steel industry, was destined to become a soldier. In 1886, at the age of 18, he was a cadet at West Point. In 1890 he became second lieutenant Fifth United States Cavalry, but after two years' service in chasing Indians, resigned his commission. His commercial and engineering service with the

General Electric Company commenced in 1894 and was continuous until June, 1916, with the exception of six months' service as captain of Company E, Second Regiment New York Volunteers during the Spanish-American War in 1898, and four months' service as colonel on the Mexican border in 1916. Aside from his government service he was active in state military affairs. His first appointment was as first lieutenant of the Thirty-sixth Separate Company in 1895, which later became Company E, Second Regiment New York Volunteer Infantry at Schenectady, N. Y. He was commissioned major in the Second Regiment in 1901 and was made colonel in December, 1912. During Theodore Roosevelt's term as governor of New York, January 1, 1899, to January 1, 1901, Col. Andrews served as aide-de-camp. In August, 1917, he entered the One Hundred and Fifth Regiment United States Army as colonel, and is at present serving his country somewhere in France.

L. R. Berkeley, Lieut.—Lieut. L. R. Berkeley is a graduate of Cornell University and was connected with the superintendent's office and the brush testing laboratory of the National Carbon Company for a number of years, and prior to his enlistment was a brush sales engineer for the National Carbon Company. He enlisted October 1, 1917, in the officers' training camp, Camp Arthur, Texas, and left for France in February, 1918. He is assigned to Company D, One Hundred and Seventh Engineers, and has been moving from place to place on engineering work, and up to the present time has seen no first line service.

H. E. Billington, Capt.—H. E. Billington is now captain of field artillery and is assigned to the Fourth Corps Artillery Park, now located at Camp Wadsworth, S. C. He entered the Second Officers' Training Camp at Ft. Oglethorpe, Ga., on August 26, 1917, and was commis-

sioned first lieutenant Field Artillery, November 27, 1917. He was assigned to the Three Hundred and Thirty-fifth Field Artillery, Camp Pike, Ark., where he acted in the capacity of battery commander until May 7, 1918, when he was transferred to the Fifth Regiment, F. A. R. D., at Camp Jackson, S. C. He was adjutant of the Fourteenth Battallion until June 2, 1918, when he was commissioned captain and appointed regimental inspector-instructor. On July 24 he was transferred to the Fourth Corps Artillery Park, Camp Wadsworth, S. C., and is now in command of Company C. Captain Billington took charge of the Pittsburgh office of the Automatic Electric Company, about December 1, 1915. Previous to his connection with the Automatic Electric Company he was sales manager of the New York Central Iron Works Company, Hagerstown, Md. Before that he was connected with A. M. Castle & Co., of Chicago, Jones & Laughlin Steel Co., and several well known firms.

Wm. Van. C. Brandt, Ensign—Mr. Brandt, after spending several years at the United States Naval Academy, at Annapolis, entered the employ of the Electric Storage Battery Company, at Philadelphia, November, 1912, as salesman in the Pennsylvania sales office. In June, 1914, he was promoted to manager of the Pittsburgh sales office of the Electric Storage Battery Company, which position he held with great credit to himself until January, 1918. In January, 1918, he accepted a commission as ensign in the United States Naval Reserve forces, being assigned to the submarine branch. He entered the United States Submarine Training School and Naval base at New London, Ct., about the end of January, 1918, and completed his course of training about the latter part of July. Since he received his German hunting license his impatience to get after the Hun prompted him to take a temporary assignment in transport duty while waiting for his assignment on board a submarine and he therefore, entered service immediately on board one of the largest United States transports, commissioned as ensign. He has made one trip across and back, during which time, they have seen considerable service. While the censor does not permit the details of their trip to be published, Mr. Brandt advises that their boat carried over about 5,000 troops and that they entered a very active submarine zone, within which two boats were sunk within 50 miles of them, one of them being the Carpathia which the newspaper accounts have described. They were within sight of one submarine. Mr. Brandt is fire control officer of the after battery of five-inch gun and depth charges.

J. O. Corbett, Lieut.—Mr. Corbett enlisted in the Fifteenth Engineers Corps, which was organized by Col. Judson early last year, receiving a commission of first lieutenant, which commission he still retains. After the regiment was formed the boys were camped at Oakmont for a month or more, and last May a year ago they entrained and were immediately sent overseas. One of Mr. Corbett's friends says of him: "I have every reason to believe that Mr. Corbett will acquit himself admirably as

a soldier as well as an engineer not only on account of his pleasing personality and military bearing, but also due to the fact that some years ago he was in government employ, having charge of the building of several of the locks in our rivers in the Pittsburgh section. He was a member of the National Guard, namely the old Fourteenth Regiment, being captain of Company C of that regiment, hence his previous engineering and military experience qualified him as a member of this engineering corps and I feel quite confident that by the time the war is over he may receive a commission of major or colonel." Very recently one of Mr. Corbett's friends met a French officer and incidentally asked him if he had ever met a Mr. Corbett on the other side. The French officer stated that he had and Mr. Corbett had asked him to advise all inquirers on this side that he was still "running true to form." The many friends of Mr. Corbett who know him best will appreciate the humor of this expression. His present address is First Lieut. Jim O. Corbett, Fifteenth Regiment Company C., United States Engineers, American Expeditionary Forces, France, via New York.

Samuel C. Eaton, Lieut.—Mr. Eaton, who was formerly electrical foreman at the Midvale Steel and Ordnance Co., is now a lieutenant in the army aviation section. After having attended the training camp at Mineola, Long Island, he was ordered South. A letter from him dated February 19, 1918, tells of his having finished the required test, and being qualified as an American army aviator, receiving a commission as a lieutenant, and sent to Camp Dix, Dallas, Tex. He was active in the Philadelphia section of the Iron and Steel Engineers. April 1 he was transferred from Dallas, Tex., to Mellville, Ill. aviation field, stationed as an instructor. July 1 he was picked first of five men to be an instructor of instructors for the Northern field. On July 4 he was requested to give exhibition flying over the Sunset golf links, at St. Louis. Since joining the service he has been married, and the government has given him a home on the aviation field.

Richard Fishback, Private—Richard Fishback graduated from Rose Polytechnic Institute at Terre Haute, Ind., in 1912. He immediately went to work for the Wagner Electric Manufacturing Company, at St. Louis, and after about one year's work he left the Wagner company to become associated with the Underwriters Laboratories at Chicago, and shortly after going there was made their agent at Milwaukee, where he had charge of inspection and label service for the Underwriters Laboratories in the Milwaukee district. While with them he was offered a position as district manager for the Allen Bradley Company, at Pittsburgh, which he accepted and spent about a year and a half in Pittsburgh until he left the Allen Bradley Company to go to Cleveland as a sales engineer for the Dravo-Doyle Company. He was located with this company until June of this year, when he enlisted in the mechanical end of the aviation

Iron and Steel Electrical Engineers



Capt. W.R. Glasgow



Col. J.M. Andrews



Lieut. A.G. Montgomery



Lieut. A.B. Starr, Jr.



E.O. Oeter's



Capt. H.E. Billington



E.H. Fisher



Lieut. Stanton S. Hertz



Capt. E.H. Martindale



fight for U.S. in War and Industry



Lieut. J. O. Corbett



Lieut. A. M. McCutcheon



Lieut. C. J. Mundo



Lieut. C. C. Lynde



Lieut. Van C. Brandt



Sergeant J. Simonich



Lieut. L. R. Berkeley



J. H. Albrecht



C. A. Huebner



section of the Navy and since that time has been at the Great Lakes Training Station.

E. H. Fisher, Private—Mr. Fisher left for Camp Lee in September, 1917, being formerly connected with the B. V. Fittings Company, Philadelphia. He is in the Utilities branch, Quartermaster Corps, Camp Lee, Va. At the present time he is in the Convalescent Barracks 9017, Base Hospital, Camp Lee, Va., where he has been for three months, due to illness.

C. D. Gilpin, Captain—Captain C. D. Gilpin was born in Philadelphia, Pa., in 1880, and graduated from the William Penn Charter School, in 1897, after which he spent five years at Drexel Institute, graduating from the Electrical Engineering course there in 1902. He was employed in the electrical department of the Wellman - Seaver - Morgan Company in 1902. In 1905 he became electrical engineer, which position he held until the first of this year, when he went into the government service. Captain Gilpin occupied a very responsible position with the Wellman - Seaver - Morgan Company, having charge of the electrical design and equipment of the company's 17-ton ore unloaders and ore bridges for many of the docks along the Great Lakes as well as the 150-ton pontoon floating cranes, one of which was furnished the Portsmouth Navy Yard, Norfolk, Va., also a duplicate machine which is now being installed at

the Mare Island Navy Yard, San Francisco. This immense crane at Portsmouth started without a hitch in any detail which reflects great credit upon Captain Gilpin in view of the magnitude of this installation. Captain Gilpin finished the military course of training at Camp Lee, Va., in the middle of April. Since that time he has been connected with the Engineering Depot of the government at Washington, engaged in purchasing electrical equipment.

W. R. Glasgow, Captain—W. R. Glasgow, formerly with the American Steel Foundries, at Granite City, Ill., is now doing active service in France. He attended the First Officers' Training Camp at Plattsburg, later he went to Ft. Sheridan to attend the Second Officers' Training Camp. He left New York for France about the middle of January, 1918. He is captain of field artillery, training in a French artillery school for three months.

Stanton S. Hertz, Lieutenant—Stanton S. Hertz,

aged 24, was born in Montgomery, Ala., June 17, 1894. He received his preliminary education in the public and high schools of Montgomery, and graduated from the Alabama Polytechnic Institute at Auburn, Ala., with the degree of electrical engineer at the age of 16. The youngest man ever graduated from Auburn in this profession. Immediately after graduation he became connected with the Westinghouse Electric & Manufacturing Company, where he remained 3½ years. He was night superintendent of the dynamo testing department when he left, to accept a position with the Electrical Engineering & Manufacturing Company as sales engineer. In February, 1917, he was elected secretary of the Electrical Engineering & Manufacturing Co., from which position he resigned to enter the service of the government. He volunteered his services to the chief of engineers of the Army the day after

President Wilson declared war and was accepted and commissioned second lieutenant in July, 1917, assigned to Searchlight Troops. In April, 1918, he was commissioned first lieutenant. He arrived in France about June 1, 1918, and is at present with the American Expeditionary Forces, Six Hundred and Third Engineers.

C. A. Huebner, Private—C. A. Huebner was a salesman in the industrial division of the Pittsburgh office of the Westinghouse Electric & Manufacturing Co. He left



WINDSOR CASTLE.

Soldiers of the United States, the people of the British Isles welcome you on your way to take your stand beside the armies of many Nations now fighting in the Old World the great battle for human freedom. The Allies will gain new heart & spirit in your company. I wish that I could shake the hand of each one of you & bid you God speed on your mission.

George R. I.

April 1918.

This letter of welcome from King George is printed on the reverse side of stationery presented to United States soldiers arriving in England—The letter is reproduced from a message received from C. A. Huebner.

the company February 8 and was sent to Camp Lee, where he was inducted into the Infantry Depot Brigade. In April he was assigned to the One Hundred and Twelfth Infantry, Twenty-eighth Division, at Camp Hancock. In May he was sent to Camp Upton and soon boarded ship for oversea service. Mr. Huebner had a very unusual experience at this point, as he was taken off the transport after making considerable progress and brought back to New York with a lieutenant of his company. These two men were given the duty of rounding up men who were absent without leave. In other words, quite a number of soldiers who should have reported for that transport did not, and it was Huebner's job to find them and turn them over to the proper authorities. He completed this rather unusual and none too pleasant task shortly after that and finally arrived on the other side some time during June. His address is Private C. A. Huebner, Company M. One Hundred and Twelfth Infantry, Twenty-eighth Division, American Expeditionary Forces, via New York.

Paul W. Jones, Captain—Captain Jones is a graduate of the mechanical engineering department Cornell University, class of 1912. Immediately after graduation he entered the employ of the Cutler-Hammer Manufacturing Company. From 1914 to 1917 he was sales engineer in the steel mill department of this company in the Cleveland-Pittsburgh district. In May, 1917, he was commissioned captain in the United States Army

Reserve Corps, and ordered to active service in the ordnance department in June of the same year. Since this time he has been United States Army inspector of ordnance material. He has been located in various plants in Pittsburgh, Baltimore, New York and last June was ordered to Canada. Captain Jones is now located at Hamilton, Ont., and has charge of inspection in eight plants. His work has covered the inspection of forgings, machined shell and shrapnel, cartridge cases, time and high explosive fuses and shrapnel, and machinery and gun material. In a letter to THE BLAST FURNACE AND STEEL PLANT, Captain Jones says: "I hope to get to France soon and trust that I may be associated with the 'Steel bunch' after the war."

Charles C. Lynde, Lieut.—Charles C. Lynde, formerly engineering editor of THE BLAST FURNACE AND STEEL PLANT, graduated from Purdue University in 1913. He enlisted in May, 1917, passed his examinations for a commission in the Engineers, U. S. R., and at once entered the officers' training camp at Ft. Oglethorpe, Ga. After a month at Oglethorpe his section was ordered to Bel-

voir, Va., at which camp—and at Washington Barracks, he finished his training course. At the close of the training period in August he was assigned to the Three Hundred and Sixth Engineers, as first lieutenant, engineer train, and ordered to Camp Jackson, S. C. In October he was detached and sent to Camp Funston, Kan., to organize a train in another regiment. Some six weeks later he was again detached and ordered to report for active duty abroad. Arriving in France, he served for a time as a distributing officer escorting and billeting troops as they arrived; and later was attached to the office staff of the engineer purchasing officer, which position he is still filling. The following most interesting experience of Lieut. Lynde is taken from one of his letters: "Last night, not having any appetite at supper time, I donned my 'kepi' and went for a walk. Chance led me to the railroad station where I found a U. S. provost guard surrounded by a clamorous group of refugees, all asking questions at once, and none of them getting any answer. I butted in, and with what French I could command straightened things out for the folks, got them safely

aboard the street car they wanted, and then meandered into the station to see how many evacuees and refugees there were, anyway. I found there six Red Cross men, a like number of Red Cross nurses and five Y. M. C. A.'s trying to shepherd trainload after trainload of people from the region affected by the last Boche push. And out of the entire bunch there were

only two with any pretensions toward French! So, metaphorically speaking, off came my coat and I got busy. It was 7 p. m. when I got there, and it was 10 minutes to 4 this morning before I started back to my room and bed. During the intervening time I unloaded baggage, carried babies, baggage and old people from the trains to the canteen, explained their needs to the nurses there, saw to their bodily comforts as far as possible, reassured them as to the safety of their few personal effects, and generally acted as cicerone to them and interpreter for others. The canteen must have fed 10,000 people during the hours I was there, not to mention the hundreds of poor people who needed medical aid as well. The long strings of refugees, and the little neighborhood knots who made their way down the roads back of the front to the nearest railroad station, were pretty badly cut up, some of them, by Boche machines flying low and ripping them up with machine-gun fire. Why, only Wilhelm knows, and when he is finally called on for a reason he'll have none! But the people struggled on, nevertheless, to be piled in serried heaps on flat cars on the refugee



Capt. C. D. Gilpin.



Lieut. S. C. Eaton.



Capt. P. W. Jones.

trains and then to have their few goods and chattels piled around them. The train which was the worst we got last night left a point 70 kilometers east of here at about 10 a. m., and had the misfortune to lose its first locomotive through German shell fire, and had to wait for four hours in an exposed position, under intermittent shelling, while another engine was found, had pushed the cripple onto a siding, and could get the train under way again. And all the while a Boche airplane, low enough for the refugees to make out every detail of the driver's appearance, hovered so low that there couldn't possibly be any excuse of "military necessity" for the shelling. During the long wait many of the people piled off in the lee of the train, while occasional bursts of shrapnel stirred up their bedding and clothing on the cars. And when the train finally did get itself started, it had slow going, owing to the enormous traffic in the opposite direction. But it finally got in, with some 60 or 70 cars crowded as tightly as possible with people—most of whom had had nothing to eat since early morning or the day before, and nothing to drink save skimpy swallows of wine. Many were wounded, some were sick, and there was one woman whose baby was born during the shelling."

George J. Mallon, Lieut.—Lieut. Mallon was born in Philadelphia and has lived there most of his life. He was a graduate of the University of Pennsylvania, and came to the Cutler-Hammer Manufacturing Company in 1911, being connected first with the engineering department and then in the sales department, going to the Pittsburgh office. Lieut. Mallon was extremely well liked by his associates in this company, and had an unusual combination of spontaneous good humor, with an active and analytical mind. He is in the United States Navy, and in transport service. For a time he was with the United States steamship Mount Vernon, care of postmaster, New York City, and a letter addressed thus should eventually reach him.

E. H. Martindale, Captain—Captain E. H. Martindale is a graduate of the Case School of Applied Science and was connected with the brush department and later with the brush testing laboratory of the National Carbon Company for a number of years. At the time of his enlistment he was associated with the sales department of the National Carbon Company as a brush engineer. He enlisted on July 1, 1917, in the officers' training camp at Ft. Leavenworth and was transferred to France in February, 1918, and is now connected with the Engineers Reserve Corps. His headquarters at present are in Paris, and he is occupied as a consulting engineer in the installing of high tension power lines. Capt. Martindale is one of the managers of the American Institute of Electrical Engineers and the chairman of the Industrial and Domestic Power Committee of that organization. Capt. E. H. Martindale, Engr. R. C., care of D. C. & F. A. P. O. 717, American Ex. Forces, France, writes from Tours, France, saying: "I am now in the Electrical and Mechanical Section of the Department of Construction

and Forestry. We make up the plans and supervise the construction of all mechanical and electrical work in the A. E. F. with the exception of that carried on in the so-called army areas. The work is practically consulting engineering and is very interesting. The nearest I have been to the front was six miles from the front line and I did not see much excitement with the exception of having a German airplane fly overhead while the French anti-aircraft guns were firing at it and having a piece of the shrapnel from the aerial bombs drop within 25 feet of me."

A. G. Montgomery, Lieut.—A. G. Montgomery was born at Volga, Ia., December 23, 1887. After the usual public school course, and three years at the Pittsburgh Academy, he entered the Pennsylvania State College in 1907, taking the electrical engineering course. Graduating from State College in 1911, he entered the employ of the Westinghouse Electric & Manufacturing Company, in June, 1911, remaining with this company until February 16, 1914, during which time he served his two-year apprenticeship course, and worked on the testing floor. February 16, 1914, he entered the employ of the American Steel & Wire Co., as the electrical engineer, in the Pittsburgh district engineering department, which position he held until August 25, 1917. At this time he resigned in order to enlist in the Reserve Officers' Training Corps, attending the camp at Oglethorpe, Ga. In November of this year he was commissioned first lieutenant in the Seventy-sixth Regiment Field Artillery, being assigned to Camp Shelby, Hattiesburg, Miss. He remained at this camp until about February 27, 1918, when in conjunction with some other men, he was sent to France in advance of his artillery company, for the purpose of taking a special course in radio work, at a French school. He finished his course at this school about June 1, and was transferred to the headquarters company, on Col. River's staff. His present address is, Seventy-sixth Field Artillery, American Expeditionary Forces, via New York. Word was recently received that Lieut. Montgomery was at Chateau-Thierry at the start of the recent Allied drive, receiving and transmitting wireless messages from airplanes to his battery. The following is an extract from a letter which has been received from Lieut. Montgomery: "Did not see any U-boats on the way over, although there was no telling how many there were under the surface of the water. There are several old castles in this burg, which I expect to visit next Sunday, that being the only time I have off. School starts at 8 a. m. and we are through at 5:30 p. m., with one hour for lunch, then we are back again from 7 p. m. to 9 p. m. Stayed one night in a very beautiful chateau, with marble stairs, hard wood floors, electric light, water and other civilized conveniences. Every large house that I have seen in France is built of stone, with no provision for heat, so consequently they are not real comfortable on a cold night. Did not come to this place direct, but went

quite near the firing line, so that we could hear the big guns at night."

Charles J. Mundo, Lieut.—Charles J. Mundo first lieutenant of engineers who is now with the American Expeditionary Forces in France, was born in Boston, Mass., April 16, 1885. He graduated from Harvard with a B. S. degree and then spent one year in the Graduate School of Applied Science. After spending nearly two years at the Lynn factory of the General Electric Company, he entered their Schenectady office in 1909. In 1911 he became illuminating engineer in the Pittsburgh office of this company. He made a special study of steel mill lighting and was chairman of the Illumination Committee of the Association of Iron and Steel Engineers. He was instrumental in organizing the Pittsburgh section of the Illuminating Engineering Society. He is also a member of the American Institute of Electrical Engineers. Lieut. Mundo foresaw the need of military preparedness and attended the Plattsburg camp in the summer of 1916, where he passed the examinations and received the commission of second lieutenant in the infantry. In April, 1917, his commission expired, due to the age limit. As there was a great demand for engineers, he then applied for a commission of first lieutenancy of engineers. He received his commission in June and was sent to the Officers' Training Camp at American University, Washington, D. C., in September. After he finished his training he was made an instructor in the next Officers' Training Camp at Camp Lee, Va. After this camp, he was sent to the replacement troops at Camp Humphreys. He was there only a few weeks when he was sent over seas.

A. M. McCutcheon, Lieut.—Lieut. A. M. McCutcheon before joining the Reliance Electric & Engineering Co., was associated for several years with the engineering department of the Crocker-Wheeler Company. He is a graduate of Columbia University, with the degree of electrical engineer. He joined the former company in December, 1914, as chief engineer, and had exclusive charge of designing work, being directly responsible for the development of the Reliance type T motor, which has proved so successful as a heavy duty, general purpose, constant and adjustable speed direct current steel mill motor. In November, 1917, following an urgent call for experienced electrical engineers to be trained as electrical officers for ship board, he offered his services to the Navy, and following six weeks' intensive training at Annapolis, obtained a commission as lieutenant, junior grade. He was assigned to the United States steamship Louisiana, and has made a very commendable record on that ship.

E. O. Oeters, Private—Edgar Oeters, formerly connected with the Philadelphia Bourse, enlisted February, 1918, and took a course in the ordnance department at the University of Pennsylvania. He spent three months

at the arsenal at Camp Hancock, Augusta, Ga., and sailed for France about July 1.

C. O. Phillips, Corporal—Mr. Phillips, for some time connected with the Midvale Steel & Ordnance Co., is now a corporal in active service.

F. E. Riling—Mr. Riling, formerly with Harvey Hubble, Inc., Philadelphia, is now in the aviation corps.

John Sherman—Mr. Sherman, formerly connected with the Philadelphia office of the American Conduit Manufacturing Company, enlisted about May 1, 1918, and is now with the ambulance corps in France, Field Hospital 319, Three Hundred and Sixth Sanitary Train, Eightieth division, American Expeditionary Force.

J. L. Simonich, Sergeant—J. L. Simonich was born February 22, 1891, at Joliet, Ill. He attended the University of Illinois and graduated in 1915. He entered the employ of the Pittsburgh Crucible Steel Company June 24, 1916, and was employed as assistant steam and hydraulic engineer, which position he held until May, 1917. At this time he enlisted in the United States Engineering Corps, Fifteenth Regiment, Company B, stationed at Oakmont, Pa., near Pittsburgh, and was given rank as sergeant. His company was sent to France in July, 1917.

Frank P. Singer, Captain—Frank P. Singer, of Toledo, O., and a member of the A. I. S. E. E., is now a captain in active service.

Arthur B. Starr, Jr., Lieut.—Arthur B. Starr, Jr., was in the employ of the Duquesne Light Company from September 1, 1915 to May 7, 1917, when he was granted leave of absence to take up active military service. He was assigned to the Field Artillery Reserve Corps with a commission of first lieutenant and was stationed at Camp Meade. A postal card received from him about five weeks ago advised that he had arrived safely overseas. He was a member of the Reserve Officers' Training Camp, at Plattsburg, and prior to his being assigned to Camp Meade, had attended the Officers' Training Camp at Fort Niagara. It might be of interest to know that he has only two brothers, and that both of them are in the service. Lieut.-Com. Fletcher Coleman Starr is a graduate of Annapolis Naval Academy, and another brother, Lieut. Charles Bowman Starr has been in France for quite some time.

The service flag of the A. I. S. E. E. engineers contains at least 27 stars, more are being added. It is interesting to note that out of 27 of these names 18 are commissioned officers.

The 27 names can be classified into rank as follows: One colonel, six captains, 10 lieutenants, one engineer, two in aviation service, two in officers' training camp, one in ambulance corps, one sergeant, one corporal and two privates. A great many of these men are now abroad, and as the few extracts from letters printed in this article show they are doing a great work.

Fuel Economy in Blast Furnace Practise

Data on Production of English Blast Furnaces Through
Various Stages of Development—Working Furnace Model
Built for Determination of Efficient Distribution of Charge.

By T. C. HUTCHINSON.

The Skinningrove Iron Company's blast furnace plant consists of five furnaces, each 82 feet high, 23 feet diameter at throat, and 26-foot bosh, and six blowing tuyeres. The two original furnaces have 8-foot hearths, and Nos. 3, 4 and 5 have 10-foot hearths.

Nos. 1 and 2 were built by the Loftus Iron Company and blown in by them on October 17, 1874. Both furnaces were damped down on May 23, 1877, when the Loftus company went into liquidation. These two furnaces were acquired by the Skinningrove Iron Company in 1880, and were blown in on the original lining in September, 1880.

No. 1 furnace was blown continuously by the Skinningrove Iron Company from September, 1880, until December 31, 1900, on the original lining.

No. 2 was blown in October, 1874, and continued blowing to May, 1877, a period of 2 years and 7 months, and then again from September, 1880, until April 14, 1903, a further period of 22 years and 7 months on the original lining, a total life of one lining of 25 years and 2 months.

Nos. 3, 4 and 5 were built by the Skinningrove Iron Company with 10-foot hearths. No. 4 was lighted up on October 6, 1895, and is still blowing on the original lining, after a period of 22 years and 3 months. No. 3 was lighted up on January 22, 1896, and is still blowing on the original lining, a period of 22 years. No. 5 was lighted up on November 9, 1901, and was blown out on July 10, 1915, and is now being relined. The furnaces blowing at this date are Nos. 1, 2, 3 and 4.

The following is the life of each furnace lining, and make of iron on original lining:

No. 1 Furnace.

Oct., 1874, to May, 1877, 2 yrs. 7 mos.; make in tons, 49,162
Sept., 1880, to Dec., 1900, 20 yrs. 3 mos.; make in tons, 562,815

Life of lining..... 22 yrs. 10 mos.

Make of iron..... 611,977

No. 2 Furnace.

Oct., 1874, to May, 1877, 2 yrs. 7 mos.; make in tons, 50,524
Sept., 1880, to Apr., 1903, 22 yrs. 7 mos.; make in tons, 625,362

Life of lining..... 25 yrs. 2 mos.

Make of iron..... 675,886

Paper read before British Iron and Steel Institute.

No. 3 Furnace.

January, 1896, to January, 1918, still blowing on original lining.

Make to January, 1918, 769,900 tons.

No. 4 Furnace.

October, 1895, to January, 1918, still blowing on original lining.

Make to January, 1918, 747,674 tons.

No. 5 Furnace.

November, 1901 to July, 1915:

Life of lining..... 13 years 7 months

Make of iron..... 518,257 tons.

At the May meeting of the Iron and Steel Institute in 1908, I had the pleasure to present a paper on the "Mechanical Cleaning of Ironstone," and the fuel economy resulting therefrom. This paper is printed in No. 111, 1908, pp. 38-58, of the "Journal of the Iron and Steel Institute."

In the present article I propose later to consider the conditions in the blast furnaces that secure such long life of furnace lining, and the fuel economy resulting therefrom; but at the moment I will confine my remarks to the importance of effectually cleaning the ironstone at the belt, for this question of cleaning is altogether apart from that which relates to the life of furnace linings, and by either means fuel economy can be effected independent of the other.

Ten years have elapsed since 1908, when I presented my paper on mechanical cleaning of ironstone. The experience of these 20 years has confirmed the figures I reported in 1908. From that date, careful attention has been given to secure the rejection at the belt of all impurities that could be mechanically treated.

A check sorting bench was established near the furnaces quite apart from the cleaning belt at the heapstead. Each week two trucks of ironstone have been taken from the trains, after leaving the cleaning belt, and these trucks have been re-sorted by hand, putting impurities aside that had passed the belt. The clean stone from the sorting bench was then analyzed, and the percentage of metallic iron in the clean stone ascertained and the consumption of ironstone per ton of pig iron produced in the blast furnaces, compared with the report from the cleaning belt. These comparisons were made each month.

The metallic iron in the pig iron as received from the blast furnaces was taken at 92 per cent, this being based on average analyses entered in the laboratory report.

**Samples of No. 3 Foundry and Forge Pig Iron.
Average Analyses.**

	Per cent
Graphitic carbon	2.950
Combined carbon	0.473
Silicon	2.320
Sulphur	0.049
Phosphorus	1.570
Manganese	0.550
Arsenic	0.027
Chromium	0.063
Metallic iron	91.998

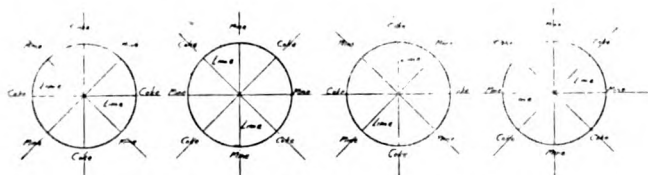


Fig. 1—Method of filling hopper of model.

The comparison instituted was as below:

If 20 cwts. of pig iron contained 92 per cent metallic iron, ironstone containing 27 per cent metallic iron should require 68.14 cwts. of ironstone to produce 20 cwts. of pig iron.

Thus: 92 per cent $\times$ 20 cwts. = 1840 $\div$ 27 per cent metallic iron in ironstone = 68.14 cwts. of ironstone, and the converse—92 per cent. $\times$ 20 = 1840 $\times$ 68.14 = 27 per cent of metallic iron in ironstone.

The actual consumption of ironstone in the furnace for the last 10 years has been:

Year ending December 31	Ironstone, Cwts. per ton of pig iron	Percentage of metallic iron in ironstone
1908.....	68.329	26.92
1909.....	70.249	26.19
1910.....	69.71	26.39
1911.....	69.78	26.36
1912.....	70.08	26.25
1913.....	69.32	26.54
1914.....	70.84	25.97
1915.....	70.45	26.11
1916.....	70.09	26.25
1917.....	70.31	26.17

For more than 20 years we have analyzed every cast of pig iron produced at the blast furnaces. The low sulphur content has proved that the sulphur band brought with the ironstone from the mines can be mechanically removed at the cleaning belt.

The average analyses for silicon and sulphur from 1895 to 1906 were as follows:

Year	No. 3 Iron		Foundry No. 4	
	Silicon	Sulphur	Silicon	Sulphur
1895.....	3.09	0.019	2.45	0.040
1896.....	2.35	0.025	.....	.....
1897.....	3.06	0.023	2.58	0.034
1898.....	2.74	0.017	2.69	0.026
1899.....	3.21	0.030	2.70	0.050
1900.....	3.44	0.034	2.58	0.082
1901.....	3.07	0.039	2.71	0.060
1902.....	3.06	0.035	2.63	0.068
1903.....	2.35	0.045	2.27	0.054
1904.....	2.52	0.051	2.47	0.053
1905.....	2.71	0.037	2.35	0.046
1906.....	2.02	0.040	2.43	0.049
	12)33.62	12)0.395	11)27.86	11)0.562
	2.80	0.033	2.53	0.051

In 1908, the date of my paper, we had no steel works. Nearly our entire make of pig iron was sold to Scotland. In 1911 we used part of the make as molten iron for manufacture of steel, and then realized the importance of low sulphur iron for that purpose. At this this date, January 15, 1918, I have before me the analyses of molten iron sent to the steel melting shop that day, which is as below.

Out of 13 consecutive casts from the blast furnaces that day, 13 ladles of molten iron of about 30 tons each, or a total weight of metal of 390 tons, analyzed as follows:

Hot Metal Charged		Mixer Metal		Steel Made			
Silicon	Sulphur	Silicon	Sulphur	C.	S.	P.	Mn.
3.29	0.024	0.56	0.034	0.45	0.050	0.070	.....
3.10	0.030	.....	.....	0.44	0.050	0.046	0.69
2.30	0.044	.....	.....	0.42	0.045	0.037	0.74
3.39	0.025	0.87	.....	0.20	0.053	0.045	0.69
3.15	0.024	.....	.....	0.20	0.045	0.040	0.77
3.01	0.028	.....	.....	.....	.....	.....	.....
2.49	0.038	0.56	.....	.....	.....	.....	.....
2.87	0.036	.....	.....	.....	.....	.....	.....
2.96	0.050	.....	.....	.....	.....	.....	.....
2.72	0.023	.....	.....	.....	.....	.....	.....
2.77	0.036	0.47	.....	.....	.....	.....	.....
2.91	0.033	0.47	.....	.....	.....	.....	.....
3.01	0.041	0.42	0.035	.....	.....	.....	.....

Average of sulphur = 0.033 in molten iron.

Average of silicon = 2.91 in molten iron.

Such low sulphur pig iron could not have been produced if the sulphur band in the ironstone had

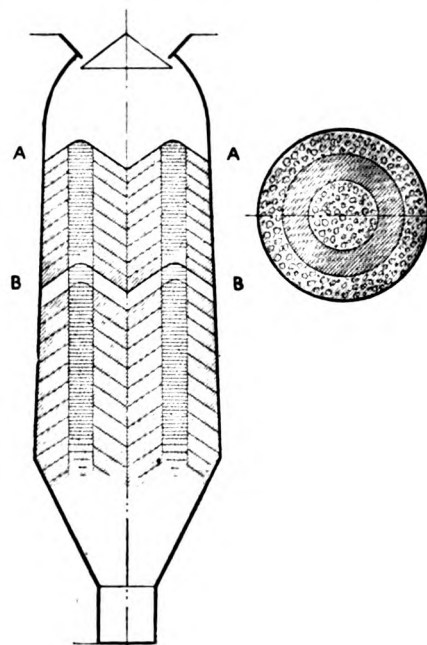


Fig. 2.

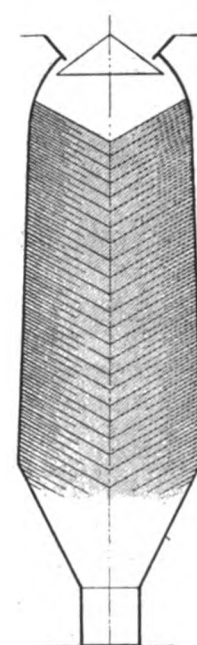


Fig. 3.

not been mechanically removed at the cleaning belt.

Fuel economy results partly from rejection of impurities before the ironstone is charged into the furnace and partly by equal distribution and admixture of the mine, coke, and limestone in the furnace itself.

The working of Nos. 1 and 2 furnaces in 1881 (the first full year of the Skinninggrove Iron Company's operations) was not satisfactory to the management.

The respective makes were: 1881, No. 1, 22,799 tons; 1881, No. 2, 23,472 tons; as compared with 24,985, the average make for that year of all Cleveland furnaces. The iron produced was mainly forge.

Neither the works chemist (a university graduate) nor the furnace manager could suggest a remedy. It was imperative that one should be found, and for that purpose a model of the furnace was prepared and made exactly to scale (1 to 48). The charging bell was made to the same scale (13 feet). A slide was broken into cubes $\frac{1}{8}$ -inch and below of varying could be withdrawn during the time the model was being filled. This model was cut vertically into two equal portions and each half sheeted with glass so as to give two closed compartments when opened for examination.

The material to be charged into the model was broken to the same scale as the model. The ironstone was broken into cubes $\frac{1}{8}$ -inch and below of varying sizes down to dead small so as to represent the proportion of large and small calcined ironstone as charged into the furnace.

The limestone was broken into cubes of $\frac{1}{12}$ -inch so as to represent the raw limestone charged into the furnace, mountain limestone being used which had to be broken by hand on arriving at the furnace, and therefore no small limestone was charged into the furnaces. The coke to the same proportion, $\frac{1}{12}$ -inch down to dead small. The experiments with this model commenced in February, 1882, and extended over several weeks.

The model was charged with small buckets one-forty-eighth the capacity of the furnace mine and coke barrows. These were tipped in the hopper of the model in the sammer manner as the mine and coke barrows were tipped into the blast furnaces (Fig. 1).

Eighty rounds were thus filled into the model and then a portion drawn from the bottom to get a clear section of the material as it descended in the furnace. Refilling was proceeded with until the model was filled, and it was then opened and there was found in the center of the section a column equal in the blast furnaces to 7 or 8 feet, composed of coke, limestone and large mine. Similar conditions existed at the walls of the model.

The ironstone, limestone and coke could be easily distinguished by the color—calcined ironstone being red, raw limestone being gray, and coke black.

On either side of the center column a distinct region of small ironstone and coke existed, and outside the column of small material, a further region of large material existed, similar to that shown in the center column.

The material charged into the model had formed two distinct cones, the apex of each being 5 feet from the wall of the furnace, corresponding with the size of bell (13 feet). The depression of each cone was

from 4 feet 6 inches to 4 feet 9 inches, large material being very marked at the foot of each cone, so that the section across the model showed large material at each wall and in the center, but two cones of small material in a direct vertical line from the apex to the bottom of the model.

The section when the furnace was full was as shown in Fig. 2 as "A" to "A." When the furnace was lowered and the model opened, the section of the lowered material was as "B" to "B."

The bell, equal to 13 feet diameter in the furnace, was taken out of the model and another bell, equal to 15 feet 6 inches diameter, was inserted, and material charged as in the previous experiment. When the model was opened the section was found to consist of lumpy material in the center, the whole of the small ironstone and small coke being thrown against the wall. There was a much deeper inverted cone in the center corresponding with the increased diameter of the bell. Material equal to 35 charges was then drawn from the bottom of the model and the burden fell 12 feet. It was found that the small coke and ironstone had descended close to the walls of the model to the entire depth down into the well of the furnace, the larger material descending in the center of the cone the material becoming smaller as it approached the walls of the model.

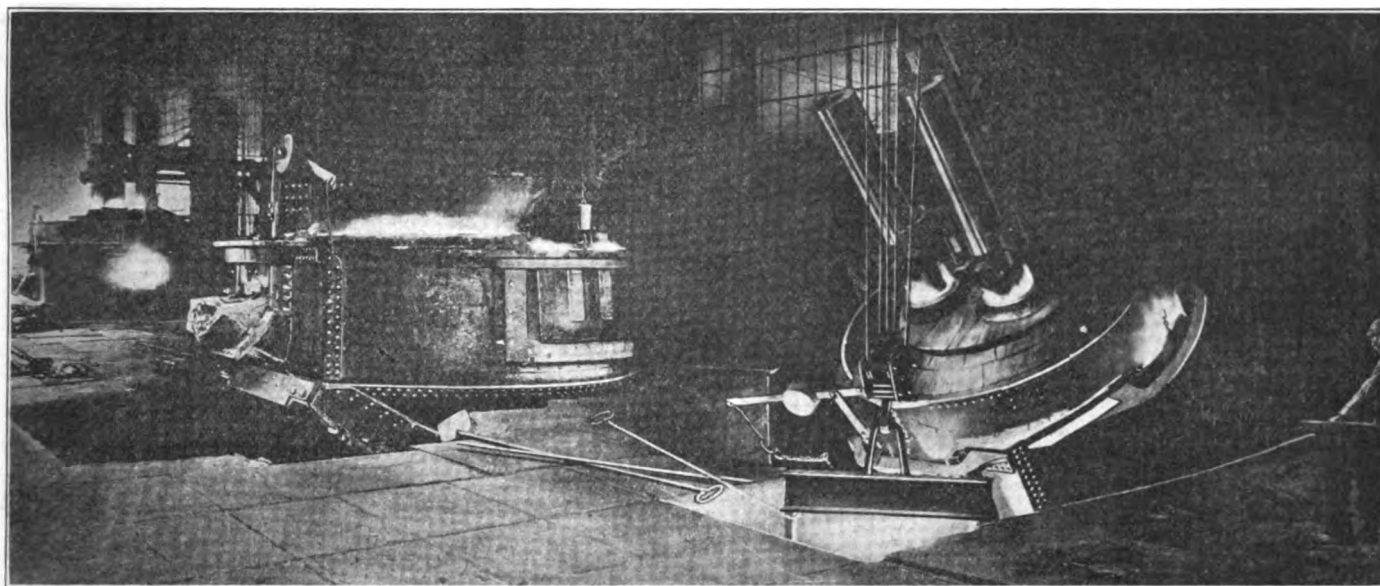
Experiments were made with various sizes of bell and deeper hoppers, the throat of the model being contracted to correspond with a smaller bell, filling being continued and drawing at the same time. These sections proved unsatisfactory.

The contracted throats were removed and the model restored to the original dimensions, the 15 feet 6 inch bell being applied and the model recharged and drawing from the bottom at the same time. When opened the small was again found close to the walls down to the well of the furnace and large material in the center, as before. Fig. 3 shows the form of bell which was finally decided upon.

From the section shown in the model charged with a 13-foot bell, it was aparent what was the cause of the irregular working of the furnace and the irregular quality of iron produced in 1881.

It was clear the small coke and ironstone, which had formed the center circular ring of denser material, throwing the larger ironstone and limestone against the walls of the furnace and into the center column, had permitted the gases to ascend in the furnace in two distinct columns, and prevented the closer material being acted upon in the zone of reduction, so that it came down into the hearth of the furnace unprepared.

The next and concluding installment of this article will appear in the October issue of THE BLAST FURNACE AND STEEL PLANT.



Electric Steel Production for Small Units

Description of Cold Metal Method Predominating in Electric Furnace Units Under Ten-Ton Capacity — Data on Six-Ton Heroult Furnace Making High Carbon Chrome Steel.

By ARTHUR V. FARR.

America has been known as a producer of steel in quantity and it has been but recently that the quality element has been emphasized. The continued production of quality steels is making America's reputation symbolic of both quantity and quality.

A newcomer in the industry and a factor in the production of higher grade steels, is the electric furnace method of production. Starting with 10 electric furnaces in 1910, the growth in the number of installations has been rapid until May 1, 1918, saw 265 furnaces either in operation or in the course of construction in this country. Production for 1917 of 235,000 gross tons. The United States has not only maintained its commanding position as a producer of electric steel, but the record of 1917 emphasizes this leadership. The United States and Canada are producing at the present time probably a little less than half of the world's production.

Electric steel is made either by melting a cold charge and refining it in the electric furnace, known as "cold melt electric steel," or by refining in the electric furnace the molten charge from the open hearth or Bessemer or a combination of both. This latter method is applicable especially to furnaces of capacity of 10 tons and upward, the cold melt method not having proved successful to date in the large units.

For smaller units of under 10 tons capacity, the cold melt method predominates. This is due largely

to the simplification of equipment and the assurance of electric steel quality. Although there is economy in duplex or triplex methods of making electric steel, certain it is that plants equipped exclusively with electric furnaces cannot be accused of merely "washing" the open hearth steel in the electric furnace. It cannot be gainsaid that satisfactory steel can be produced by the open hearth electric furnace method, provided, of course, that sufficient time is allowed for refining in the electric furnace. Perhaps this point is best illustrated by the present-day attitude taken by some steel purchasers. A request for quotation was sent by a large purchaser of chrome steel and contained the following: "If you are not in position to quote on either electric or crucible steel, we prefer that you disregard the inquiry as we do not care to consider open hearth steel or open hearth with electric furnace refinement." While this attitude cannot be considered as typical, it shows the discrimination that particular purchasers have found necessary to exercise in safeguarding the quality of their product.

We will describe briefly the method of manufacture of cold melt electric steel in a six-ton Heroult electric furnace as being representative of the majority of installations in this country.

The process of manufacture may be divided into two periods, namely, (1) melting and oxidizing, and (2) recarburizing and reducing.

It appears paradoxical to remove carbon during one period and to add it at another, but this is neces-

Paper read before fifth annual convention of American Drop Forge Association.

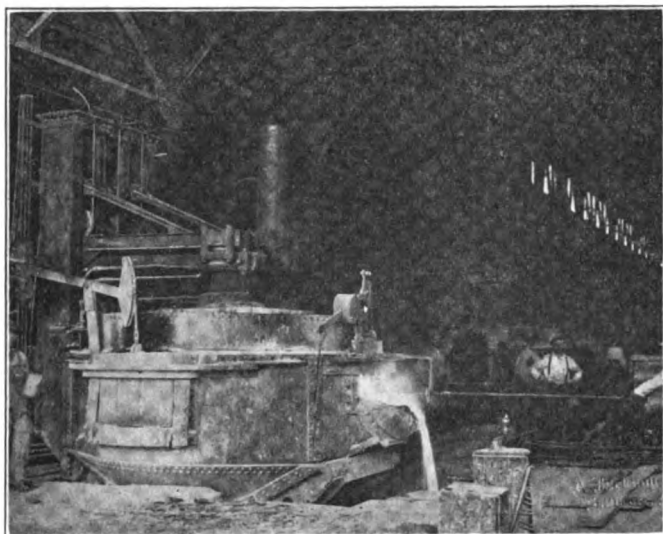


Fig. 1—Pulling the slag off the furnace.



Fig. 4—Pouring the Ingots.

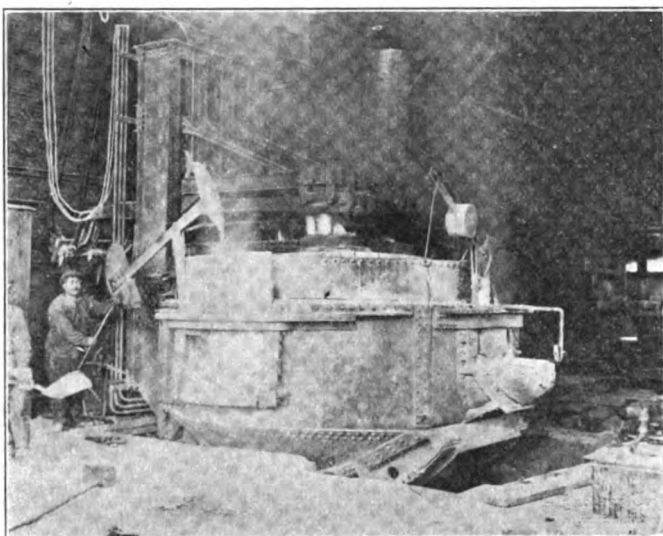


Fig. 2—Adding a mixture of lime, coke dust and fluorspar to the bath in the recarburizing period.



Fig. 5—Stripping molds by means of traveling crane and special hooks.

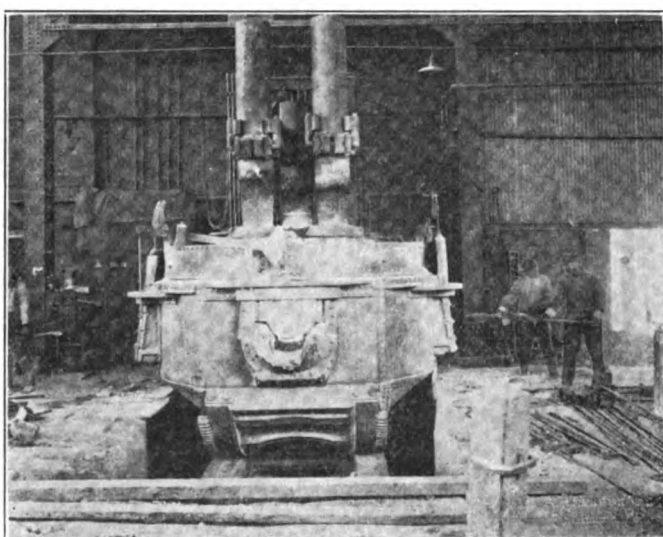


Fig. 3—Charging repair material for the lining between the heats.

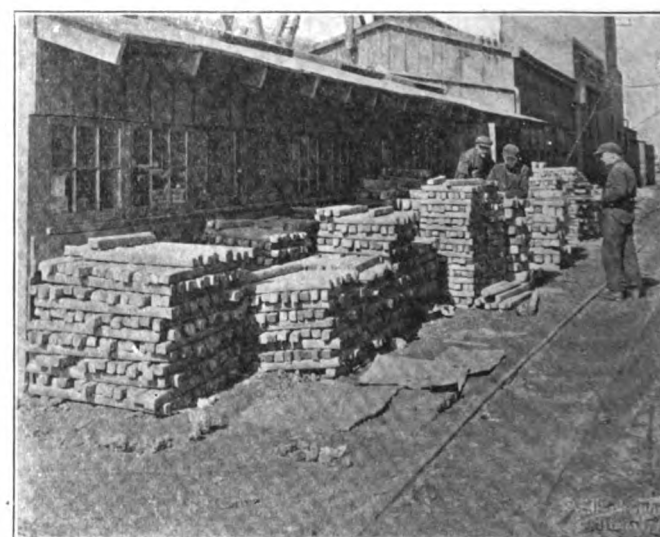


Fig. 6—Stockyard, showing piles of 6-inch chipped billets ready to be forged into rings.

sary in order to oxidize the phosphorus. Furnaces for reducing phosphorus are lined with basic material, such as magnesite or dolomite. Limestone is charged into the furnace with the scrap. The rust on the scrap furnishes the oxygen and sometimes ore or roll scale is charged to augment this supply. The slag formed oxidizes the phosphorus which then combines with the lime, forming calcium phosphate. Carbon, silicon, manganese and sulphur are also oxidized to a greater or less extent by this slag.

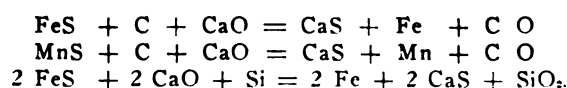
As an illustration of the furnace reactions that take place, the following schedule is given, showing the various stages in the making of a heat of electric steel. The steel to be made was a high carbon chrome steel used for balls for ball bearings.

Furnace Six-Ton Heroult.

11:50 A. M.	Material charged:				
	Boiler plate.....	5,980 lbs.			
	Stampings	5,991 lbs.			
			11,971 lbs.		
	Limestone		700 lbs.		
12:20 P. M.	Completed charging.				
	(Current switched on.)				
3:20 P. M.	Charge melted down.				
	Preliminary analysis under black slag.				
	Analysis:				
	C.	Si.	Su.	Ph.	Mn.
	.06	.014	.032	.009	.08
3:40 P. M.	The oxidizing (black) slag is now poured and skimmed off as clean as possible to prevent rephosphorizing and to permit of adding carbonizing materials. For this purpose carbon is added in the form of powdered coke, ground electrodes or other forms of pure carbon.				

The deoxidizing slag is now formed by additions of lime, coke and flourspar (and for some analyses ferro silicon). The slag changes from black to white as the metallic oxides are reduced by these deoxidizing additions and the reduced metals return to the bath. A good finishing slag is creamy white, porous and viscous. After the slag becomes white, some time is necessary for the absorption of the sulphur in the bath by the slag.

The action of desulphurization in the electric furnace is as follows: After the bath is oxidized, as described above, the slag acts on the metallic sulphides, eliminating them by forming calcium sulphide, which is taken up by the slag. The desulphurizing actions are illustrated by the following equations:



The white slag disintegrates to a powder when exposed to the atmosphere and has a pronounced odor of acetylene when wet.

Further additions of recarburizing material are added as needed to meet the analysis. The further reactions are shown by the following:

3:40 P. M.	Recarburizing material added:				
	130 lbs. ground electrodes.				
	25 lbs. ferro manganese.				
	Analysis:				
	C.	Si.	Su.	Ph.	Mn.
	.76	.011	.030	.008	.26

To form white slag there was added

225 lbs. lime.
75 lbs. powdered coke.
55 lbs. fluor spar.

4:50 P. M.

Analysis:					
C.	Si.	Su.	Ph.	Mn.	
.75	.014	.012	.008	.28	

Note the reduction of the sulphur content.

During the white slag period, the following alloying additions were made:

500 lbs. pig iron.
80 lbs. ferro silicon.
9 lbs. ferro manganese.
146 lbs. 6 per cent carbon ferro chrome.

The furnace is now rotated forward to an inclined position and the charge poured into the ladle, from which in turn it is poured into molds.

5:40 P. M. Heat poured.

Analysis:					
C.	Si.	Su.	Ph.	Mn.	Cr.
.97	.25	.014	.013	.33	.70
Ingot weight poured.....					94%
Scull					2.7%
Loss					3.3%

Total current consumption for the heat 4,700 kw hours, or 710 hw hours per ton.

Electric steel because of its density should be cast in inverted molds with refractory hot top to prevent any possibility of pipage in the body of the ingot. In the further processing of the ingot, whether in the rolling mill or forge, special precautions are taken in the heating, in the reduction of the metal and in the cooling.

In this article there has been made no attempt to compare at length the relative merits of open hearth and electric steel. I do not believe that is necessary because results in service, day in and day out, have thoroughly established the superiority of electric steel. Individual laboratory tests do not always square with results in the field—but it is the latter that are wanted. One forger expressed his experience tersely as follows: "We can get physical properties much easier with electric steel." Ten years of experience in this country and in Europe indicate that electric steel in its natural qualities is equal to crucible steel and superior to the steel ordinarily made in the open hearth.

The rare purity of the heat derived from the electric arc, combined with definite control of the slag in a neutral atmosphere explain in part the superiority of electric steel. Commenting on this recently, Dr. H. M. Howe stated that in the open hearth process you have such atmosphere and slag as you can get, and in the electric you have such atmosphere and slag conditions as you desire.

The ultimate consumer in a large measure is the court of last resort, determining what steels shall be used in the manufacture of his product. It is the ultimate consumer who realizes that the best materials obtainable are none too good.

Steel Plant Educates Foreign Employes

Youngstown Sheet & Tube Company Establishes System of Free Schools Primarily for Educating and Americanizing Foreign-Born Employes in All Parts of the Mills.

In accordance with its practice of affording to its employes, whether they be of foreign birth or otherwise, every advantage in the way of increasing their efficiency, promoting their happiness and uplifting their ideals of life in the workshop and in the home to the American standard, the Youngstown Sheet and Tube Company early in 1917 established a system of free schools. This system was the result of much

enrollment contained the names of more than ninety men and a few women. The organization was completed under the direction of George B. Fout, who as supervisor, has since that time had charge of this school and the additional schools conducted at East Youngstown, Struthers, and the camp community on the south side of the main plant.

The course consists of reading, writing, spelling,



View showing typical school room where foreign-born employes are taught first principles of American citizenship.

thought and was designed primarily for the benefit of the foreign-born employes in all departments of the mills, but at the same time it was deemed wise to offer its opportunities to others than employes of the company, and to also include among those to be benefited by it the women connected with the households of the non-English speaking workmen.

With this end in view, through its industrial relations department, the company opened on January 8, 1917, in the Gordon Avenue School Building, at East Youngstown, where most of its foreign-born employes reside, the first of these schools. The initial

grammar and arithmetic. At the beginning six teachers were employed, and the first term began on January 8 and closed the first week in June. During this period regular sessions were held on Mondays, Tuesdays and Wednesdays. The first session, from 8:30 to 9:30 in the morning, was intended for men employed from noon until midnight; the second session, from 3 to 4 p. m., for those employed on the night turn; and the third session, from 7:30 to 9 o'clock in the evening, for men employed on the day turn. Women were admitted to all these sessions and encouraged to attend those which were most convenient.

In addition to the regular sessions, special classes for instruction in citizenship, civic and kindred branches were conducted on Thursday of each week. These classes were especially designed to assist applicants for citizenship, and in them were taught the underlying principles of American government. The relation of the individual to the village government and that of the village to the city, the state and the nation were brought out as fully as possible.

During the first year 50 per cent of all who enrolled in these schools attended every session, unless they were detained by their employment, or by some other cause, and the success of the movement was such as to lead to its extension at the opening of the second term, which occurred during the first week of September, 1917. At that time additional schools were established in the Holy Trinity parish school house, at Struthers, and in a building erected for that purpose at the large industrial camp, near the main south gate to the works. The enrollment at the beginning of the second term had risen to more than 200, and contained a few additional women. In spite of the fact that special efforts have been made to enlist the interest of foreign-born women in these schools, not much success has been achieved, probably because of their many home duties.

The increase in the number of schools led to the employment of 14 teachers during the 1917-18 term. These teachers were selected chiefly from among the teachers of the public schools of the city of Youngstown, and were paid only for the time they were actually engaged in the work. Very much of the success of the schools has been due to their enthusiastic devotion to this work, and it would seem that one of the conditions necessary to the efficient operation of such schools is a spirit similar to that shown by these teachers.

During the second term, embracing the period from September, 1917 to June, 1918, attendance at the classes was even more satisfactory than during the previous term, and the results accomplished toward Americanization of those enrolled were appreciably better. During this term about 175 men who had been attending these schools, entered the military and naval service of the United States, either by enlistment or through the operation of the selective service law; and during the same period more than 200 employees of the company made application for American citizenship. Gratifying as this fact is, it had the effect of reducing somewhat the attendance at these schools, since the impression was created that such attendance was in some way likely to increase liability to military duty. Nevertheless, during this period not less than 500 men and women attended these schools at various times, and the greater portion of them showed marked progress in a knowledge of the English language, as well as of American cus-

toms and ideals. A feature of the instruction which was found most beneficial was that along the lines of home ideals and sanitation. Vocal music was also encouraged in the schools and had a beneficial result each year.

At the closing of the term special exercises were held, including addresses, music, and the presentation to those who had been faithful in their attendance of a certificate, attesting the appreciation by the company of their desire for self improvement.

At various times during the terms, dinners and entertainments were given in connection with these schools. These were attended by the president, one or more of the vice presidents and other officials of the company, as well as by about 75 superintendents and foremen; some of the latter were accompanied by their wives and all mingled freely with the pupils of the schools. At the last of these about 450 persons attended and the gathering resulted in much encouragement for the movement.

Arrangements have been made for the continuation of the schools already established and the starting of an additional school at the Hubbard furnace of the company, where it will be available for the employes of those furnaces, as well as for those in a large industrial camp located in that vicinity. It is probable that during the coming term, which will open on the second Monday in September, the services of at least 20 teachers will be required.

During the last term efforts were made to secure practical evidence of the value of these schools from an industrial standpoint. Fifty check numbers were selected from among those assigned to workmen attending the schools and these were submitted to the general superintendent, who caused to have made, through the superintendents and foremen of the various departments in which these men were employed, an investigation as to the effect of their attendance at the schools. In every case it was found that these men were among the most efficient, careful and satisfactory workmen in their departments. In view of this fact, the company has made an effort to have it generally understood among foreign-born workmen, that their attendance at these schools will be appreciated and will redound to their benefit as employees.

The general observation may be made that these schools, regarded as among the most successful connected with any industrial plant in the country, owe a portion of their success to the peculiar conditions existing at this plant, where a very large portion of the foreign-born employes live in the village of East Youngstown and form practically its entire population. As a general proposition experience suggests that this Americanization work can be efficiently and economically performed through the public school system, and wherever it is possible to secure proper coöperation on the part of the school officials this is probably the better plan.

Suggestions for Gas Producer Operation

Tests and Curves Show Important Relations of Factors Influencing Operation—Depth and Position of Ash Bed Determined by Unique Device—Careful Attention Essential in Successful Operation.

By F. DENK.

After the first disinclination against using it is overcome, there is no reason why producer gas should not work just as satisfactory as natural gas. It is true natural gas is the most ideal fuel, but it must be considered that the available quantity of this fuel is becoming less every year, and something else has to be applied in place of it. It is only natural that a factory manager who was using natural gas all his life is a little dubious when it comes to applying producer gas; but after he is used to it there is no reason for not getting the same results with the new fuel as with the old one.

In the following some pointers will be given which will help the men in charge of a gas producer house to obtain good results.

The accompanying illustrations show some important relations which show interesting characteristics in gas producer operation. Of the four illustrations Figures 1, 2 and 3 belong together, while Figure 4 shows a different relation.

Figure 1 illustrates the interdependence between the percentage of carbondioxide (CO_2), carbonmonoxide (CO), the amount of steam blown for a certain fixed quantity of air (here 40 cu. ft./lbs. coal gasified) and the gas temperature. Under good working conditions the increase in the amount of steam blown, referred to a certain quantity of air, will reduce the temperature of the gas leaving the producer. This, in turn, causes a reduction in the amount of CO in the gas, corresponding to an increase in CO_2 , thus making a rich gas lean. Figure 1 shows these conditions plainly. The data from which the curves have been plotted have been obtained from tests made especially for the purpose of determining the relations in questions for good working conditions.

Figure 2, on the other hand, shows the relation of the same items under poor working conditions, the gas having been burning above the fuel bed due to channels or holes, which allowed free air to pass through the ash-bed and through the incandescent coal. This free air, coming in contact with the gas burnt its combustible constituents either wholly or partly, thus raising the gas temperature as well as the percentage of CO_2 , at the same time decreasing the percentage of CO , notwithstanding the fact that the amount of steam blown was increased. This leads to the conclusion, that a large volume of steam blown accompanied by a high producer.

A comparison of Figures 1 and 2 shows that at .15 pound steam blown per 40 cubic feet of air, the gas temperature is, in both cases about 1,300 deg. F. (The gas temperature curve in Fig. 1 must be elongated beyond the

border line on the top.) For .35-pound steam per 40 cubic feet of air, however, the temperature in Fig. 1 is only 860 deg. F., whereas Fig. 2 shows 1,480 deg. F., indicating a combustion of CO (as well as of some of the hydrocarbons). The curves are submitted only to illustrate the general conditions, as the tests on which they are based, have been made with different coals, which, naturally, give (under otherwise equal conditions) different percentages of CO_2 and CO and also different working temperatures. They also show that with a quantity of .25-pound steam 40 cubic feet of air which is the best steam air ratio to be blown per pound of coal gasified, the amount of CO_2 in the gas should not vary more than between 4 and 6 per cent and the amount of CO between 24 and 28 per cent. In Fig. 3 it can be seen how investigations made under ordinary working conditions prove the correctness of the statements made above and illustrated in Figs. 1 and 2.

Between 12 o'clock midnight and 6 a. m. on the following morning there occurred a slight drop in temperature (considering the average curves only), corresponding to a slight drop in CO and an increase in CO_2 . From then on until 11 a. m. a continuous drop in temperature took place accompanied by a similar drop in CO and an increase in CO_2 . This corresponds fully with Fig. 1. The same holds good for the time between 5 p. m. till 6 a. m. (at the right end of the curves), where there is a more or less continuous increase in temperature with a corresponding increase in CO and a decrease in CO_2 . At the end of the test (6 a. m.) the temperature was a little higher than at the beginning (12 m.). Correspondingly, the percentage of CO in the gas is a little higher and that of CO_2 a little lower at the beginning, all this conforming to Fig. 1. But how about the time between 11 a. m. and 5 p. m. (at about the middle of the curves)? Between 11 a. m. and 1 p. m. the curves show a rise in CO and a drop in CO_2 . So far, the conditions agree with Fig. 1. The temperature curve, however, continues to rise until 4 p. m., so does the CO -curve but also the CO_2 -curve. The latter increase is apparently against the rule laid down in Fig. 1 according to which it should drop, but it also seems not to be in line with the curves Fig. 2, which require a drop of CO whenever the temperature and the per cent CO_2 rise. Yet, a closer inspection of the curves in Fig. 3 will prove the correctness of Fig. 2. It can be seen that the temperature at 4 p. m. is about the same at the start and at the end of the test, but that the per cent CO is much less. This indicates a combustion of CO , forming CO_2 , which latter, there

fore, becomes higher than normal. Thus the per cent CO is decreased—lower than normal—which again is in line with the curves in Fig. 2. From 4 p. m. to 5 p. m. the conditions are regular again, viz.: temperature drop—CO drop—CO₂ increase.

Fig. 4 indicates the influence, which the charging of the producer has on the gas temperature. About one minute after the coal is lowered into the producer the gas temperature drops rapidly and steadily for about four minutes until it starts to rise again. The temperature difference amounts to 500 deg. F. This proves the producers should not be charged all at the same time, as the high temperature drop would seriously affect the working of the plant.

The incandescent bed of fuel must be carried on a bed of ashes several feet thick. This is necessary in order that the fuel shall gradually burn out and cool before being discharged.

The producers should be cleaned and the clinkers

rate of gasification should be decreased, but it should not go below 700 pounds per hour.

In the operation of a producer, the personal equation is a very important factor. Conscientious and careful attention on the part of those in charge of the producers will increase their efficiency. It is a well-established fact, that poor results obtained in one plant as compared with another often are almost entirely due to carelessness. On the other hand, it should be borne in mind that sometimes conditions exist beyond the producers, which materially alter the results. Especially should the gas lines have watchful care, that dust accumulations do not obstruct pipes and valves. Cleaning attachments (scrapers, etc.) should be carefully located for the convenience and least labor of the attendant.

Simple water gages will often be a useful guide when registering the pressure at top and bottom of the producer or on the system; this is especially necessary where an inspection is irregular. At the top of the producer

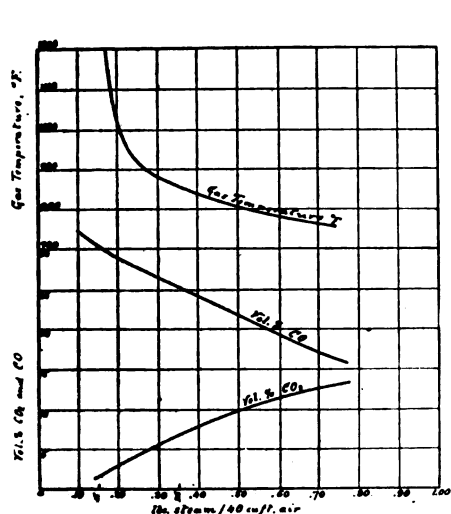


Fig. 1—Curves for constant quantities of air, but varying amounts of steam.

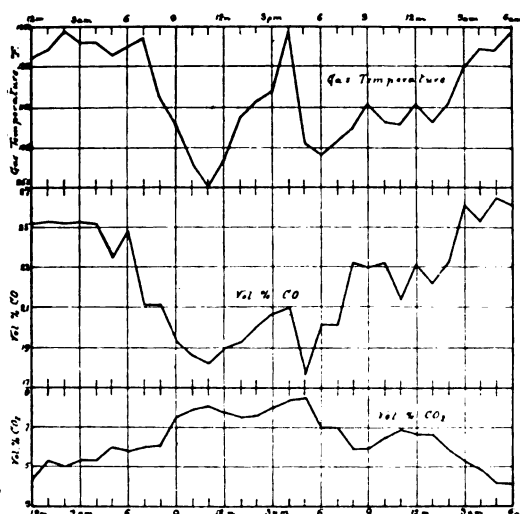


Fig. 3—Curves showing relation between gas temperature, per cent CO and per cent CO₂. Data taken from actual test.

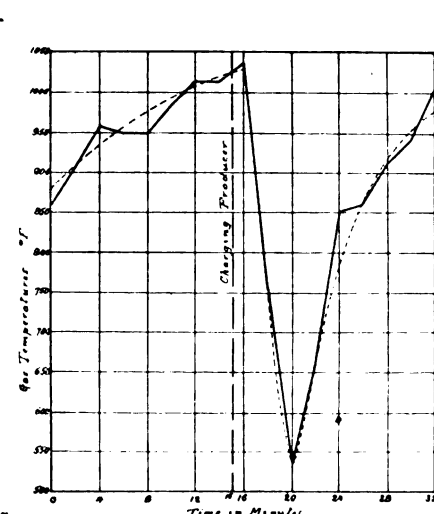


Fig. 4—Curve showing influence of charging the producer on the temperature of the gas.

removed whenever the conditions demand it, as, if this is done in too long intervals, it involves a large amount of hard and trying labor and necessitates the carrying of a shallow bed of fuel, because otherwise the men cannot force their bars through it from above which must be done in case the clinkers should become too heavy. This shallow fuel bed results in a lean, poor gas, for one of the essential conditions for making rich gas and for decomposing the steam is a deep bed of incandescent fuel.

The work with the bar from above should be merely to distribute the fuel properly over the surface after it has been dropped from the hopper.

For the coal in use at present (Pittsburgh No. 8) the gasification should be not less than about 12 pounds of coal per square foot of producer area per hour, corresponding to approximately 1,000 pounds of coal per hour. With careful working, this gasification can easily be increased if necessary. Only in case the quality of the coal falls off, either due to an increase of ash or sulphur, or to a considerable amount of fine material, the

this pressure should be between $\frac{1}{2}$ - to $\frac{3}{4}$ -inch of water column. In all cases frequent analyses of gas should be made by means of an Orsat, so that factors governing the working of the producers could be determined and properly regulated. The amount of carbondioxide (CO₂) in the gas should not be more than 5 to 6 per cent.

It is not right to increase the gasification by simply opening the steam valve, thus increasing the pressure and the amount of steam blown. It is true this will give more gas, but of inferior quality. The amount of steam blown should not be more than is just required for preventing the formation of clinkers. A thick fuel bed can be maintained, when the ash bed is kept low by cleaning out the producers in regular intervals. Cleaning should be done at least once a day, but if conditions demand, cleaning must be done whenever necessary. The cleaning reduces the dead resistance in the ash bed acting against the entrance of the air, while the useful resistance in the fuel bed will be increased, allowing a heavier bed of

incandescent fuel. The ash bed should be brought up to a point about 6 to 7 inches above the blast hood and should at no time approach nearer. Neglect of this precaution may cause the loss of the blast hood. The depth of the fuel bed should be from 2 to 3 feet.

The distance from the charging floor to the top of the fuel bed does not allow conclusions to be drawn in regard to the thickness of the latter, because it does not throw any light on the thickness of the ash bed. This, however, may be determined by inserting a rod of necessary length through one of the poke holes into the ash bed as far down as possible. After the rod has been left in this position for a few minutes it can be taken out and inspected. The lower part, as far as it extended into the ash bed, will be dark, the middle part, indicating the thickness of the fuel

soot. The former is an inert, i. e., valueless part of the producer gas, whereas the latter deposits in the lines. At a temperature of 900 deg. F. nearly all the CO is reduced. The temperature has, therefore, a most important bearing on the working of the producer. Hot working increases the velocity of the chemical reactions and favors all those producer actions which increase the percentage of combustible CO and retards its oxidation when once formed. The gas thus generated will have a higher heating value, which, naturally, makes possible higher temperatures of combustion in the furnaces. The amount of CO₂ in the producer gas will, therefore, give an indication of the working of the producer. Five to 6 per cent of carbon dioxide in the gas, as stated in No. 6, shows a good working of the producer under ordinary conditions.

A good gas can be obtained with the following gas-air ratio:

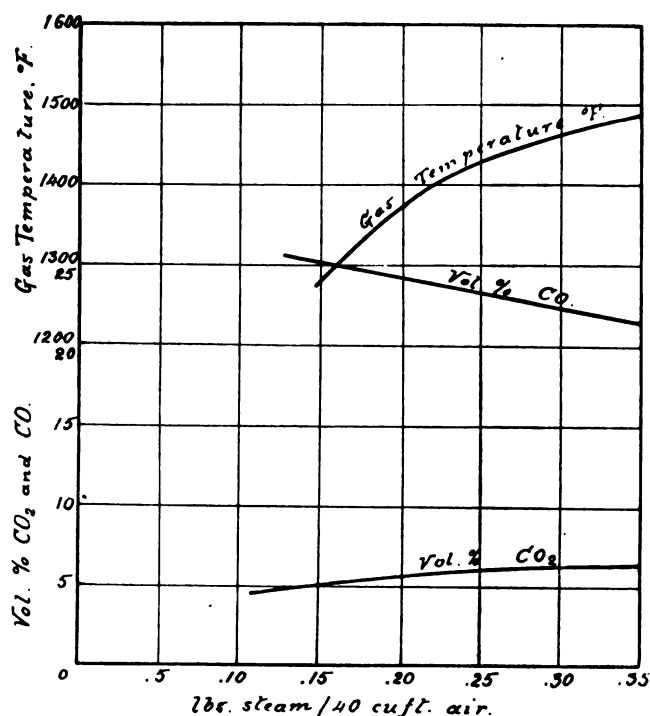


Fig. 2—Curves showing relation between Vol. per cent CO₂, CO and the gas temperature, for constant quantities of air, but varying amounts of steam—Bad working conditions—Gas burning above.

bed, will be of more or less bright red color, while the upper part will be dark right above the red piece and then red again. This latter condition is due to the hot gases leaving the producer. The conditions are shown in Fig. 5.

It is always a sign of a high ash bed on a water seal producer when the water on the bottom of the apparatus is bubbling. This is caused by the steam not being able to pass through the ash bed on account of the latter's thickness, and taking the shortest way to escape, goes into and through the water seal.

Deposition of soot shows a cold working of the producer. This is due to the fact that the combustible constituent, carbon monoxide (CO) is reduced at low temperatures and forms carbon dioxide (CO₂) and

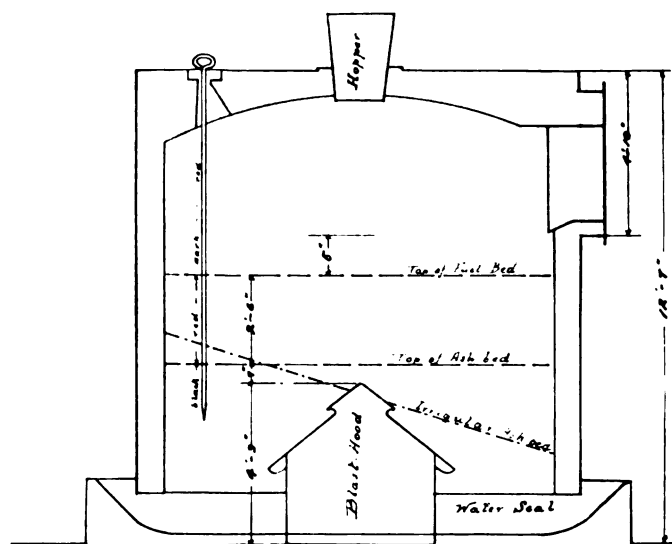


Fig. 5—Section through producer, showing thickness of ash bed and fuel bed.

.25 pounds of steam per pound of coal, and 40 cubic feet of air per pound of coal gasified.

While the amount of steam blown can easily be determined by means of pressure gages, the amount of air used in making the gas can only be found by means of the Orsat apparatus.

Among the most common sources of trouble in operation are irregular charging and neglect of attendants to close up the channels, which permit air to ascend freely and which are sure to form in the bed, however the producer is fed. The gases and air tend also to seek the walls, and the bed must be sufficiently solidified by stoking to retard this and close up the openings. (See also Fig. 3.) A too thin fuel bed will also produce the same results, inasmuch as the air gets in too freely, burning the gas within the producer, thus making a lean gas for the furnaces.

Problems of Steam Cylinder Lubrication

Operating Mechanical and Hydrostatic Lubricators in Relation
to Complete Atomization of the Oil — Steam Condition
Considerations for Effective Lubrication.

By W. F. OSBORNE.

PART II.

After the point of introduction has been determined and the lubricating oil selected, attention should be given to the means provided for getting the oil to the desired point. This is accomplished by the use of one of the many types of lubricators which may be generally classified as hydrostatic and mechanical. Both are, of course, familiar to all operating engineers and their principles of operation need not be explained. It might be well, however, to discuss some of the troubles sometimes arising, and the difference in the action of the lubricators in relation to complete atomization of the oil.

Hydrostatic lubricators provide an intermittent flow of oil, that is, the oil feeds into the steam line at intervals depending on the adjustment of the regulating valve and the viscosity of the oil. A heavy bodied oil will flow through the sight glass slowly in large drops, while a lighter bodied oil will feed in smaller drops at more frequent intervals, the latter condition giving the more uniform and more complete saturation of the steam.

Complaints are sometimes made that the oil will not feed properly, that it runs up the side of the glass, discoloring it and rendering it impossible to observe the feed. This is frequently caused by the use of a steam gage glass formerly used. If it is not possible to get a proper glass, the size of the drop may be reduced by filing down the lip on the feed valve and soldering a fine wire to the lip to allow the oil to follow the wire. If the oil backs up in the sight-feed glass, it is usually due to lack of enough difference in the pressure on the sides of the lubricator and may be improved by increasing the distance between the two connections into the steam pipe.

Mechanical lubricators are made of two types, one of which delivers a quantity of oil at intervals, which may be regulated by adjusting the length of the plunger stroke or the time required to complete a stroke. Lubricators of this type, feeding quantities of oil at comparatively long intervals, do not give the oil a chance to saturate all portions of the steam or to completely atomize before it reaches the cylinder. The other type of lubricator feeds a very small amount of oil into the steam line at every revolution of the engine, thus providing constant feed and affording a better opportunity for complete atomization and saturation of the steam. Frequently engines are exposed to very low temperatures and unless some provision

is made to keep the oil in the reservoir warmed up, it becomes thick and will not flow through the sight feeds to the plungers.

Certain types of lubricators are unsuitable for compound condensing engines operating with a pressure below atmosphere in the low pressure cylinder, unless the check valves on the discharge side of the lubricator are spring loaded, as the low pressure may cause the oil to be drawn out of the reservoir into the cylinder in large quantities with great waste.

The condition of the steam should always be thoroughly investigated before selection of a cylinder oil is made and the pressure, degree of superheat, percentage of moisture, condition of the boiler water and the general layout of pipe lines and separators carefully considered. The pressure of the steam affects the oil insofar as the temperature of the steam varies with the pressure. The temperatures of steam at different gage pressures are given in the table below:

Steam Temperatures.
(Marks & Davis.)

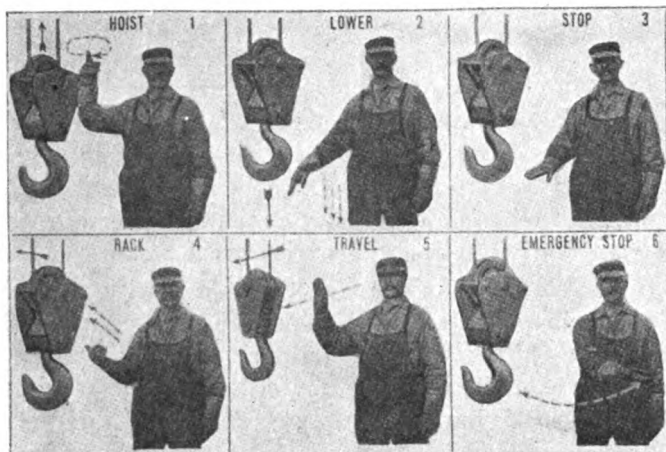
Inches Vacuum	Temp. Fahr.
28	101
26	125
24	140
Gage Pressure	
0	212
25	266.9
50	297
75	320.1
100	337.9
125	352.9
150	365.9
160	370.7
175	377.5
190	383.9
200	387.9

The highest temperature shown for steam at 200 pounds gage pressure is only 387.9 deg. F., which is far below the open flash point of any cylinder oil, and as it is probable that the flash point would be raised with the increased pressure, there does not seem to be any reason for the common belief that a very high flash or fire test is necessary. Saturated steam always contains moisture and as there is very little free oxygen present in the steam it does not seem likely that a flash could be produced in the cylinder regardless of the flash point of the oil. As long as the oil has the proper body or viscosity, a characteristic which is not influenced by the flash test, and has the ability to break up quickly, it does not seem necessary to consider this point.

PRODUCTION TOPICS

UNIFORM CRANE SIGNALS APPROVED.

The *Emergency Fleet News* publishes the following recommendations for the adoption of uniform crane signals: "The man behind the controller of a shipyard crane holds within the grasp of his hand the lives and limbs of his fellow workers. A moment's thoughtlessness or carelessness on his part may re-



(Courtesy of American Bridge Co.)

- 1—Hoist—Forearm vertical. Make small horizontal circles with hand.
- 2—Lower—Arm extended, hand below hip, wave forearm downward.
- 3—Stop—Arm extended, hand level with the hip. Hold position rigidly.
- 4—Rack—Arm extended, hand just above hip, fingers closed, thumb extended horizontally, jerk hand in direction of racking.
- 5—Travel—Forearm vertical, hand open. Wave forearm in direction of travel.
- 6—Emergency Stop—Arm extended, hand level with the hip. Move hand quickly to right and left.

sult disastrously, therefore, no man is burdened with a heavier safety responsibility than the crane operator. To avoid accidents and attain maximum efficiency in the handling of material by cranes, the foremost considerations should be the employment of competent sober men of physical fitness—especially sight—with mechanical and electrical experience, and the establishment of a definite and adequate signal system between the operators and floor men.

"Crane signals illustrated herewith are recommended as a standard by the Safety Engineering Section, United States Shipping Board Emergency Fleet Corporation to avoid misunderstanding and confusion, and all shipyards of the corporation are urged to adopt this standard system of communication. The signals should be posted in all crane cages.

"Crane operators shall observe signals only from persons duly authorized for crane service, and under no circumstances shall a load be moved

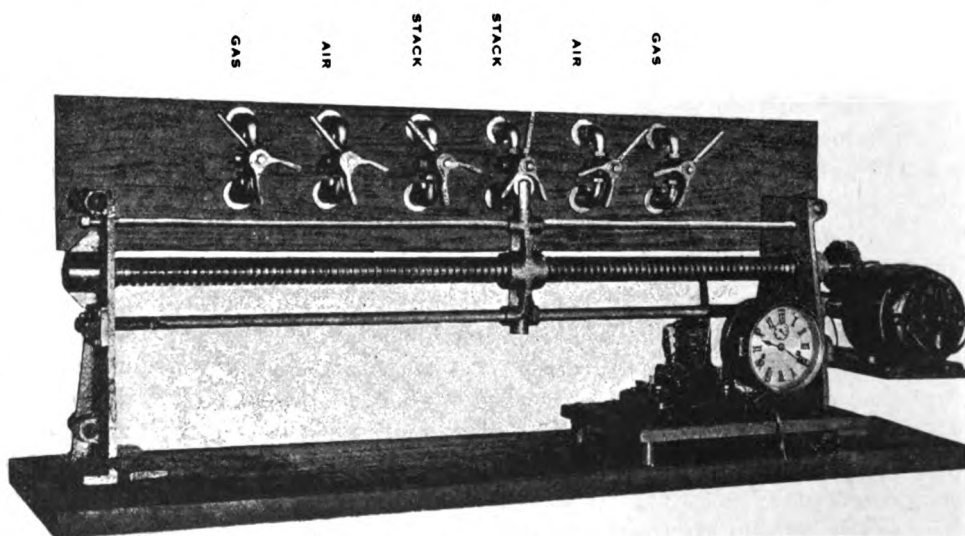
until the signal is received from the proper man. It is further recommended that the floor man wear a distinct colored cap, or, better still, a right arm sleeve of a color that will enable the operator to observe the floor man's signals more easily."

OPEN HEARTH REVERSING APPLIANCE.

In the operation of open hearth furnaces the operation of the control valves for reversing the air and gas and also the stack is of prime importance. As a rule these valves are reversed hydraulically. However, the control is manual. A machine for eliminating manual control for reversing valves has recently been patented by John Horn, and is manufactured by the Horn Automatic Machine Company, Inc., Kansas City, Mo.

In addition to automatically controlling the reversing valves this appliance, which is illustrated in the accompanying cut, by reason of its regularity claims that increased production of open hearth steel will result, also that the maximum number of heats will be secured and that the life of the furnace lining will be prolonged.

The illustration shows that the machine consists essentially of an electric motor which is $\frac{1}{8}$ horsepower and runs at 1,750 r.p.m., a clock, a traveling nut guided by two guide rods, a roller mounted on this nut, and six reversing cocks. The first three cocks being in opposite direction to the other three. When the machine is installed and in operation the cycle is as follows: Copper contacts are mounted on the face of the clock at intervals of 15 minutes. These complete a circuit with the minute hand, thus starting the motor, and operating the screw. The nut then starts on its travel and reverses each valve as it strikes the inverted Y-shaped lever. The first three valves are either opened or closed by this travel as the case may be, and the remaining valves vice versa. When the nut reaches the end of its 41-inch travel the circuit is automatically broken, stopping the motor. The travel over this distance takes about one minute. Fifteen minutes later the clock makes another contact and the nut travels back through another cycle. Red and white lights mounted on the machine indicate that the machine is in operation and that gas and air are being supplied to the furnace. The appliance is, of course, equally appropriate for heating furnaces and soaking pits.



Device for automatically reversing open hearth valves.

NEWS OF THE PLANTS

IRON AND STEEL PLANTS.

The Bethlehem Steel Company is now making substantial progress in the construction of its new blast furnace No. 1, at the Steelton, Pa., works, and plans to have the plant ready for operation in the early fall, adding considerably to the output of the blast furnace end of the local plant. The furnace has been in course of construction during the past 15 months and it had been anticipated to place it in blast during the present month, but the scarcity of material and labor conditions have retarded proposed progress. Construction is well under way on new open hearth furnace No. 22 at the steel foundry; this furnace will be one of the largest open hearth units at the plant. It is hoped to have the plant ready for operation during October. The company will increase the capacity of its power plant by the installation of a new steam turbine, replacing a unit which was thrown out of service last February, with additional capacity.

The National Enameling & Stamping Co., Granite City, Ill., is building a new blast furnace at its local plant for increased output. The company is operating the works at capacity and has plans under way for enhancing production both in blast furnace and other departments.

The Acme Steel Goods Company, Archer avenue, Chicago, will build a new steel hoop rolling mill, to cost \$175,000. The structure will be one-story, 85 x 700 feet, and located on the Calumet river. Contract for erection has been let to B. F. Wilson & Co., 154 West Randolph street, Chicago.

The Birmingham Steel Corporation, Birmingham, Ala., is the name of the new company organized by Henry L. Brittain, president of the Mobile Shipbuilding Company, Mobile, Ala., and associates, to construct a steel works for the production of steel plates, shapes, etc., for shipbuilding work. The company, with capital of \$1,000,000 has had plans and specifications prepared for the proposed plant, which will be located on a site near Birmingham. The initial works will have a capacity of about 4,000 tons per month, and will be fully equipped with machinery, to be purchased, it is understood, in the open market. A considerable portion of the plant production will be utilized by the Mobile Shipbuilding Company.

The La Belle Iron Works, Steubenville, O., with works both at Steubenville and Wheeling, W. Va., has purchased a tract of about 700 acres of land at North Follansbee, near Wheeling, for the erection of new mills. It is understood that the proposed new works will be used as an extension to the Wheeling plant.

The Bethlehem Steel Corporation, South Bethlehem, Pa., following the recent authorization of a new consolidation mortgage of \$500,000,000 to cover the various properties operated by the company, is arranging to expend an appropriation of close to \$50,000,000 for extensions and betterments at its Sparrows Point, Md., works. It is understood that the company intends to follow out the original plans for expansion at this plant, to include the construction of new blast furnaces, steel plate mills, shops, coke ovens and other structures. The works are now giving employment to about 12,000 persons and this will be increased to about 18,000 hands.

The Carbon Steel Company, Parryville, Pa., has acquired additional property, consisting of over 100 acres, in the vicinity of its works at Kittanning for extensions to its plant. The company is understood to be planning for the construction of a series of new open hearth furnaces to handle orders for the government.

The Pacific Electro Metals Company, San Francisco, Cal.,

operating a plant at Bay Point, about 30 miles distant, is now building a new 3,000 k.w. furnace for the production of ferro-manganese. The company has also commenced the construction of three new small furnaces, each 300 k.w. capacity for the production of ferro-nickel, ferro-chrome and ferro-tungsten. The plant is now operating a 40-ton silico-manganese furnace. The main furnace building to house the different departments of operation is of reinforced-concrete, about 50 x 120 feet, with adjoining electric plant and miscellaneous plant structures.

Contract has been let by the Scullin Steel Company, St. Louis, Mo., to the Crowell-Lundorf-Little Company, Cleveland, O., for its proposed new plant to be used for the manufacture of shells for the government. The works will consist of a main two-story building, about 45 x 285 feet, estimated to cost about \$200,000, with equipment. The company will also build a number of other structures for the different departments of operation.

The Symington-Chicago Corporation, Chicago, Ill., affiliated with the T. H. Symington Company, and organized to operate a new shell manufacturing plant for the government, has filed plans for the construction of the initial buildings of the new works, to be located on property at Ashland avenue and Seventy-fourth street, to cost about \$1,850,000. The structures will consist of forge shop, 220 x 425 feet, heat-treatment works, 185 x 190 feet, tool works, machine shops, shell department and other buildings, covering areas 50 x 400 feet, 80 x 250 feet, and 25 x 400 feet. The main building will be 350 x 2,000 feet.

The Gulf States Steel Company, Gadsden, Ala., has acquired a tract of about 20 acres of property in the Black Creek section, and is said to be planning for the construction of additions to its works.

NEW COKE PLANTS.

The Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., has awarded a contract to the Semet-Solvay Company, Syracuse, N. Y., for the construction of its new by-product coke plant, to cost about \$5,000,000. The new works will consist of a battery of 120 coke ovens of the Semet-Solvay type. The coke output of the plant will be used at the local iron furnaces of the company. It is expected to have the new plant completed and ready for operation within 10 to 12 months. J. W. McQueen is president of the company.

The Birmingham Coke & By-Products Corporation, Birmingham, Ala., recently organized, has awarded contracts to the H. Koppers Company, Pittsburgh, Pa., for the construction of a battery of 50 coke ovens, to form the first unit of its proposed new coke works. The proposed plant is to have a total capacity of about 750 tons of coke, and is estimated to cost complete about \$3,000,000. It is understood that the government is interested in the project and will use a large part of the output of the plant. Morris W. Bush is president of the company.

BACK NUMBERS REQUESTED.

THE BLAST FURNACE AND STEEL PLANT will pay 25 cents each for any of the following copies which readers may be able to send us:

February, July, December, of the year 1916; July, of the year 1917.

Some Pointers on By-Product Coke Oven Operations

THE BY-PRODUCT COKE OVEN; ITS PRODUCTS.

By WILLIAM HUTTON BLAUVELT.*

Sulphate of ammonia was formerly the only source from which pure ammonia in the form of aqua ammonia or anhydrous ammonia was produced. This process consists in the distillation of the sulphate of ammonia using lime to free the ammonia from the sulphuric acid, the small amount of hydrocarbons remaining in the sulphate being removed by charcoal filters or other similar means.

If anhydrous gas is to be produced the gases in the top of the still are dried by means of quicklime or other desiccating material, and the pure gas is then compressed and pumped into the steel cylinders so familiar to the trade. Aqua ammonia is produced by absorption of the pure gas in distilled water. This process is essentially a simple one, but the purification of the ammonia gas and the necessity for providing against the blocking of the apparatus by accumulations of calcium sulphate scale somewhat complicate the work.

In recent years by refinements in the distillation process it has been made possible to produce pure ammonia direct from the crude weak liquor and this product is quite equal in quality to that produced from ammonium sulphate as above described. These processes have the advantage of avoiding the waste of sulphuric acid inherent in the ammonium-sulphate process.

Effect of the War on the Ammonia Market.

The war has introduced many unprecedented conditions to the ammonia producer. Before the war the price of sulphate of ammonia varied, in general, between 2½ and 3 cents per pound. Official quotations are now running from 7.25 to 7.35 cents. While these high figures do not represent the average of actual transactions, any more than \$55 per ton frequently quoted represented prices at which the pig iron of the country was moving last summer, yet they illustrate the unsettled conditions of the market. Recently the government has asked for very large amounts of ammonia for war purposes, and this call for ammonia has introduced much discussion as to the best methods for producing it.

In times of peace the great bulk of the ammonia goes into sulphate for fertilizer purposes, and most oven plants have been built for supplying this product. The government's needs have caused many inquiries regarding the changing of these plants to produce other forms of ammonia, but this is usually practically out of the question on account of the great time and expense involved. Large parts of the recovery plants would have to be entirely rebuilt in order to change the product. Fortunately there are several practical methods for the conversion of ammonium sulphate into ammonium nitrate, and the synthetic ammonia plants will soon have a large production directly available for this purpose. The total ammonia from all oven plants now built or building is estimated at somewhat over 130,000 tons of NH_3 per annum.

Coke Oven Gas.

In the earliest European by-product ovens the gas distilled from the coal in the coking process was not sufficient in amount to heat the ovens properly and had to be supplemented with solid fuel. As the efficiency of the heating increased, the surplus, which was rather unreliable, was utilized

for raising steam. As the supply became still larger it began to be introduced as one of the regular sources of fuel in metallurgical and manufacturing plants.

In America oven gas has long been used for domestic purposes, and now over 40 important cities and towns are wholly or partly supplied with oven gas, and a number of years ago the daily sales for domestic purposes had reached 50,000,000 cubic feet. Europe has lagged far behind America in this application of oven gas.

Since the first introduction of by-product ovens into America many experiments have been made in the use of oven gas for metallurgical furnaces, and several experiments have been recorded describing unsuccessful efforts to apply it to open hearth steel furnaces, although it has long been used in heating other furnaces, soaking pits, etc. During the last few years, however, the whole subject of using oven gas in open hearth furnaces has been successfully worked out, and it is now in regular operation in several important steel plants. Since the benzol is now generally extracted from oven gas, it is the practice to burn a certain amount of tar along with the gas to give it luminosity and higher radiating power.

From 12 to 16 gallons (45 to 60) of tar, together with from 8,000 to 8,200 cubic feet (226 to 232 cu. m.) of gas, the quantity depending upon its calorific value, are required per ton of ingots produced, and it is found that furnaces fired in this way can be depended upon to produce from 10 to 15 per cent more steel than when heated with producer gas. These figures are based on work at stationary furnaces. On the basis of these figures it may be stated that the surplus gas and the tar obtained in the production of a ton of coke will furnish the necessary fuel to produce a ton of ingots from an open hearth furnace. Without considering the value of the other by-products recovered, this statement illustrates the importance of the by-product oven as a fuel supply to a blast furnace and steel plant.

Separation of Gas.

Early in the development of the by-product oven in America the principle of the separation of the richer portion of the gas, which comes off during the early part of the coking period, from the leaner portion, was developed in a practical way. This has enabled the oven plants to produce gas for sale having a calorific value much higher than could possibly be produced in ordinary gas works from the same coal.

Recovery of Benzol.

Before the general use of the by-product oven, benzol and its homologues, toluol and xylol, or solvent naphtha, were produced from the distillation of tar, which usually contains about 3 per cent of these compounds. Now the main source of supply is coke oven gas, from which the benzols are scrubbed by bringing the gas into contact with a heavy oil of petroleum or tar. This process is usually carried on after the removal of the ammonia. The benzolized heavy oil is distilled to drive off the benzols and the heavy oil is cooled and returned to the heavy-oil scrubbers. The benzols are recovered in the form of a "light oil," containing usually about 60 per cent of benzol, 12 per cent of toluol, and 6 per cent of solvent naphtha, although these percentages vary considerably with the details of the coking process and the light oil recovery.

* Paper read before A. I. M. E. meeting, New York, February, 1918.

INDUSTRIAL SAFETY

BREATHING APPARATUS AT BLAST FURNACES.

Frederick H. Wilcox, in Bulletin No. 140, of the Department of Labor and Industry, "Occupational Hazards at Blast Furnace Plants and Accident Prevention," lists a number of cases of gassed conditions around blast furnaces. Some of these are reported here to show the various types of accidents and to further show the diversity of the possibility of these chances:

1—Laborer with three men under direction of foreman was cleaning furnace top and was asphyxiated by escaping gas from about the try hole.

2—Laborer on top of checkers, cleaning same, when gas escaping from burner asphyxiated him.

3—Boiler tender was muddling up cleanout doors on dust leg and stayed in gas too long. Asphyxia.

5—Helper was working on top of boiler setting and was overcome by gas.

6—Water tender in trying to stop leak in gas burner was overcome with gas.

7—Foreman was in combustion chamber cleaning it. Became gassed and fell into hot cinder.

8—Foreman was found asphyxiated on top of boiler setting.

9—Boiler house laborer was inside setting cleaning dust out and was asphyxiated from gas from leak burner.

10—Carpenter working on scaffold in boiler house was overcome with gas and fell to floor.

There are many other cases reported in this bulletin, ranging from ordinary cases of gas to death.

It proves, and of course everyone with any experience around a blast furnace knows, the hazards of gas.

Wilcox takes up each case and deals with the mechanical possibility of preventing the recurrence of such accidents.

If all mechanical contrivances were always perfect; if men did not take chances, in fact, if everything were 100 per cent perfect then these distressing things would not happen, but do these conditions prevail? They do not and the average superintendent would gladly avail himself of any method to reduce these accidents. There is one sure way. If at any time that any man around a blast furnace is called upon to do something out of the ordinary he were instructed to put on a self-contained breathing apparatus and not allowed to do the work without it, these accidents would be materially reduced or eliminated.

The breathing apparatus, like many things, has had to undergo many changes from the old type air cylinder carried on the back and air-fed into a helmet by a hose to the new Gibbs apparatus, now for the first time being offered to the industrial and mining public. The Gibbs is the result of eight years of experiment, and tests by the engineers of the Bureau of Mines.

The Gibbs Oxygen Breathing Apparatus is an improved type, particularly in respect to the following three important features:

- 1—Automatic control of the oxygen supply.
- 2—The arrangement of the alkaline absorbent.
- 3—The prevention of excessive heat from the reaction between the carbon dioxide and the alkali.

The rate of oxygen supply is automatic. The wearer of the apparatus breathes into and from a small bellows or breathing bag. When the breathing bag is sucked flat a valve is opened, which allows oxygen to feed in rapidly from the compression tank through a reducing valve of improved design. Thus, the rate of oxygen supply is automatically controlled by the wearer's

breathing, and, as tests have shown, adjust itself with equal readiness and adaptability to his needs during rest, when the consumption per minute is only 300 or 400 c. c., and during vigorous exertion, when it is between 2,000 and 3,000 c. c. per minute.

The arrangement of the alkaline absorbent has resulted in increased efficiency and endurance, and by reason of the greater bulk of the alkali the heat is so distributed that the tendency to the development of excessive temperature is considerably reduced.

In order to be safe and efficient, breathing apparatus, whatever its type or the details of its construction, must comply with the following requirements:

1—An oxygen supply adequate alike to conditions of rest and violent exertion, and capable of being adjusted to last as long as possible, in case the wearer should happen to be imprisoned in bad air by a fall of rock or other cause.

2—Such efficient absorption of the carbon dioxide exhaled that the wearer, even during vigorous exertion and hard breathing, is not compelled to inhale enough carbon dioxide to appreciably interfere with his capacity for exertion. One per cent should be the maximum, and less than half of one per cent the aim. The absorber should be able to take up an amount of carbon dioxide corresponding approximately to the total oxygen supply carried.

3—Freedom from mechanical obstruction in the apparatus, so that the wearer may inspire and expire even during the most violent breathing without noticeable impediment; no negative pressure at any time, as poisonous gases are liable to be drawn in; and a positive pressure at the mouthpiece of not more than 5 centimeters (2 inches) water gage even during the most forcible expiration.

4—Arrangements to obviate the danger of the breathing bag or bellows being breathed or squeezed empty when the wearer is crawling in a low passage, as he is then unable to inflate his lungs and may throw off the apparatus.

5—Tightness of the apparatus so that not even the smallest quantity of the poisonous gases by which the wearer may be surrounded can be drawn into the apparatus and so reach his lungs, the apparatus to be as nearly accident proof and "fool proof" in this respect as possible.

6—The avoidance of an excessively high temperature—as produced by the absorbers now in use—and efficient heat radiation.

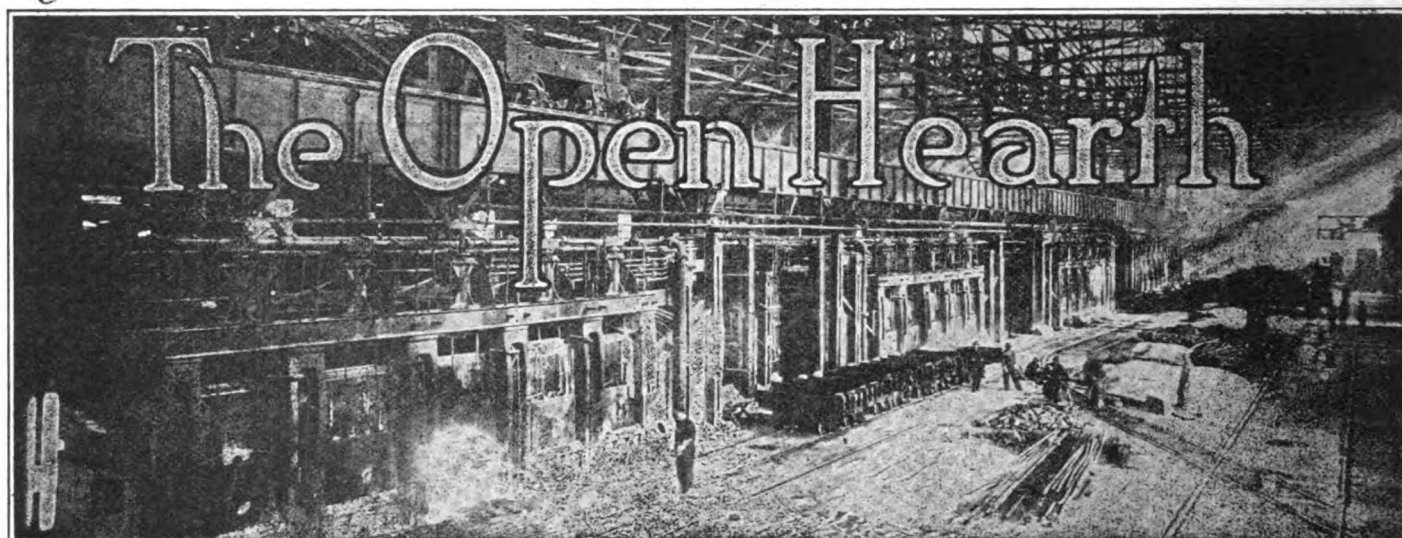
7—Simplicity of construction and such arrangements as will effectually protect the vital parts from breakage by striking against walls or roof or from the wearer's happening to fall.

The Gibbs apparatus was designed along the lines indicated in these general requirements and it is the only apparatus which has been adopted as having successfully filled the specifications.

The use of this breathing apparatus can be applied to other conditions, however, than accident prevention. There are numerous places around a blast furnace that the breathing apparatus can be used to economical advantage. Superintendents of furnaces can learn much of advantage to themselves in the safe and economical operation of their furnaces by getting in touch with the makers of this machine.

The Gibbs machine, as told in the description makes breathing practically the same as though a person did not have any machine on. This very materially reduces the training necessary, as the machine works with the wearer and not under a fixed flow.

The training of men and care of machines of this type are a big factor in the use of them. The very fact that a man is asked to put on a machine indicates the presence of gas and the men should know how to use them, and someone should know how to take care of them and test them. The merchandizers of the Gibbs apparatus (The Mines Safety Appliances Company, of Pittsburgh, Pa.), will also train purchasers of this apparatus.



C. L. Altemus has resigned his position with the Pacific Commercial Company, New York, to become assistant purchasing agent of the American International Steel Corporation, 120 Broadway, New York. Mr. Altemus was formerly with the Cambria Steel Company in the metallurgical, and later in the sales department, and was for a time identified with the American Steel Export Company.

✓ ✓

R. M. Little has succeeded Arthur H. Young as director of the American Museum of Safety, 14 West Twenty-fourth street, New York. Chester C. Rausch, a mechanical engineer, has been appointed assistant director of the museum. Mr. Rausch was educated at the Massachusetts Institute of Technology, and was later safety engineer at the Portsmouth Navy Yard.

✓ ✓

E. P. Dillon, manager of power division of the Westinghouse Electric & Manufacturing Co., in the New York office, has resigned to become general manager of the Resarch Corporation of New York. Mr. Dillon has been with the Westinghouse Company since 1909, and was previously connected with various mining and electric companies in Colorado. He was transferred to the New York office as manager of the railroad and power divisions in 1917. He was for several years assistant to the manager of the railway and lighting department at East Pittsburgh, being in charge of the power house and apparatus work.

✓ ✓

Herman C. Dornheim has resigned as secretary and treasurer of the Bronx Iron & Steel Co., and is now handling sales in the structural and bar department for Robert Grant, Woolworth building, New York.

✓ ✓

C. E. Drayer, recently elected secretary of the American Association of Engineers, with offices at 29 La Salle street, Chicago, has been actively engaged in engineering society work for the past eight years. He became associated with Dr. F. H. Newell in forming the Committee on Engineering Cooperation, of which he is secretary. Recently Mr. Drayer formulated a plan for combining the membership of the American Society of Engineers and the Cleveland Engineering Society, and present indications are that the plan will adopted.

✓ ✓

Lieut. Leonard Bonner, son of vice chairman James B. Bonner, of the sub-committee on steel distribution of the American Iron and Steel Institute, has been promoted to captain. Captain Bonner is in the motor transport division of the army, one of the youngest in the service, being only 23 years of age.

Lee R. Farrell, secretary and sales manager for the Portage Silica Company, has been appointed a member of the war service committee of the American Sand Association.

✓ ✓

F. L. Collins, of the Dominion Iron & Steel Company, Sydney, Nova Scotia, has been appointed superintendent of the electrical department of the Neville Island gun and projectile plant, Ordnance Department, United States Steel Corporation.

✓ ✓

H. C. DuBois has been commissioned a captain by the war department. Captain DuBois was formerly in charge of the sales of ferro-manganese and spiegeleisen for E. J. Lavino & Co.

✓ ✓

W. C. Root has resigned as chief engineer for Julian Kennedy, to enter the employ of Arthur G. McKee & Co., of Cleveland. Mr. Root was graduated from Massachusetts Institute of Technology in 1903, and secured his first position in the operating department of the Illinois Steel Company, at South Works. In 1904 he entered the employ of the Lackawanna Steel Company, in the engineering department, where he remained until he became associated with Julian Kennedy.

✓ ✓

Edwin M. Lavino, of E. J. Lavino Company, Philadelphia, has been commissioned a first lieutenant in the Quartermaster Department of the army.

✓ ✓

Thomas McDonald has been named the manufacturers' representative on the community labor board of the United States employment service at Youngstown. He is consulting engineer of the Youngstown district mills of the Carnegie Steel Company.

✓ ✓

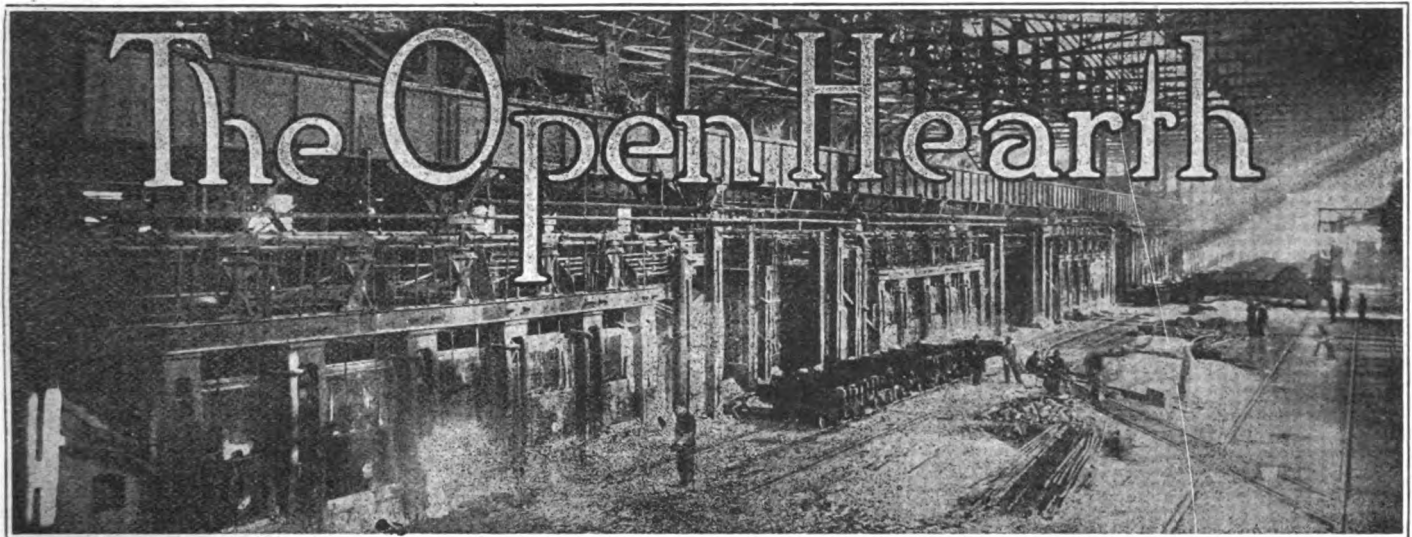
Major David A. Reed, of the law firm of Reed, Smith, Shaw & Beal, of Pittsburgh, counsel for the United States Steel Corporation, has joined the American Expeditionary Forces in France.

✓ ✓

J. H. Cheetham, formerly affiliated with the McNabb & Harlem Manufacturing Co., was recently made president of the E. B. Kunkle Company, Ft. Wayne, Ind., manufacturer of brass escapement and safety valves.

✓ ✓

Arthur W. Beresford, vice president and general manager of the Cutler-Hammer Manufacturing Company, has accepted the appointment as representative of Milwaukee employers on the community labor board, created to cooperate with the State War Labor Board.



C. B. Bauch, formerly employed by the McKinney Steel Company, of Cleveland, has accepted a position with the United States Steel Corporation in the Ordnance Department, Ambridge, Pa.

✓ ✓

H. W. Belnap has been transferred to the safety section of the Federal Railroad Administration. He was formerly chief of the Bureau of Safety in the Interstate Commerce Commission.

✓ ✓

Maurice D. Langerne has been appointed superintendent of the Seaboard Steel & Manganese Corporation, Temple, Pa. He was for several years blast furnace superintendent of the Pulaski Iron Company, and more recently connected with the Lavino Furnace Company.

✓ ✓

Terrel Croft, consulting electrical engineer of St. Louis, has been called by the educational committee of the War Department, to assume charge of the work of standardizing the electrical courses of training for enlisted men.

✓ ✓

D. V. Foster has joined the sales organization of the Hess Steel Corporation, at Baltimore, and will represent the company in New York and New England territory. He was formerly assistant general sales agent for the Midvale Steel Company, and later connected with the general sales department at the Washington office.

✓ ✓

F. M. Sacket, president, has tendered his resignation to the Brindy-Hardy Company, of Louisville. He is Kentucky Food Administrator and officer in several other companies, and has been unable to give the Brindy-Hardy Company the attention it merits.

✓ ✓

Henry Farrell, president of the Farrell Creek Steel Foundry Company, has been made treasurer and chairman of the executive committee of the Dauch Manufacturing Company, Sandusky, who manufacture farm tractors.

✓ ✓

Alexander F. S. Blackwood, who was formerly affiliated with the Michigan Steel Casting Company, in an executive capacity and later organized and was president and general manager of the Union Blackwood Steel Company, has been elected vice president and general manager of the Union Blackwood Steel Company.

E. J. Poole has been selected by local manufacturers as their representative on the Berks county labor-control board. He is superintendent at the plant of the Carpenter Steel Company, Reading, Pa.

✓ ✓

B. A. Mick, who recently entered the employ of the Hubbard Steel Foundry Company, East Chicago, Ill., as roll sales manager, was engineer of the roll and mill department of the Mesta Machine Company for 15 years.

✓ ✓

Lieut. Daniel B. McCarthy, with the American Car & Foundry Co., at St. Louis before entering the Engineers' Corps, has arrived in France.

✓ ✓

William L. Lindsley, of the Trumbull Steel Company, has joined the sales organization of the W. J. Crouch Company, Inc., steel exporter, William street, New York.

✓ ✓

L. W. Adams has tendered his resignation as general superintendent of the Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N. S., effective September 1.

✓ ✓

L. Powell has recently been made foundry foreman of the Burnside Steel Company, Chicago, of which J. M. Bossini is superintendent.

✓ ✓

Arthur R. James has been elected president and general manager of the Standard Foundry Company, Racine, Wis. Mr. Jones and others have recently purchased the holdings of the company, of which he has for several years been a stockholder.

✓ ✓

H. M. McAteer, president American Steel Export Company, is temporarily engaged in Philadelphia with the Emergency Fleet Corporation.

✓ ✓

Andrew Wheeler, of Morris, Wheeler & Co., has been called by Steel Administrator Replogle, to Washington, to accept an appointment as chief of the bureau of steel warehouse distributions of the War Industries Board.

✓ ✓

E. B. Kellar was elected treasurer at a special meeting of the and plate mills at La Belle Iron Works, Steubenville, O., has become affiliated with the Western Steel Company, Western, W. Va.

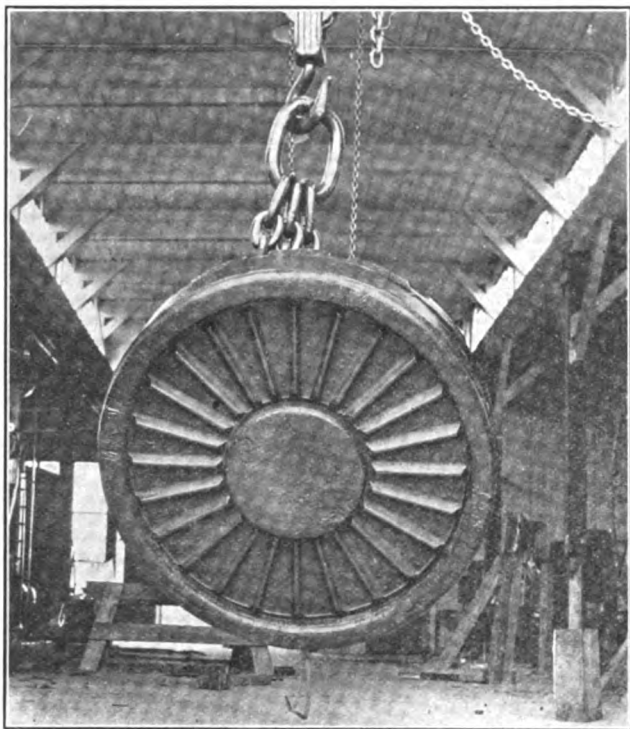
✓ ✓

E. B. Kellar was elected treasurer at a special meeting of the board of directors of the Lansdale Foundry Company, Lansdale, Pa.

WITH THE EQUIPMENT MANUFACTURERS

MILL TYPE LIFTING MAGNET.

The service rendered by the lifting magnet is so nearly indispensable that its breakdown becomes a calamity; yet of the 2,500 or over in use an average of about 5 per cent are up for repair at all times. This is a good showing for a relatively new type of apparatus but it can be improved upon. The principal causes of breakdown have been: First—Loosening of screw connections in terminal cavities causing arcs which soon burned to open ends. Second—Slow disintegration of the mica board insulation caused by the carbonization of the glue and the shellac binder, eventually resulting in a ground or short circuit. Neither of these troubles usually came in the first year of operation, but generally after 18 to 20 months' use and as mag-



Lifting magnet having braze-welded electric circuit joints, also impregnated asbestos coil insulation.

nets are expensive, a spare when purchased usually finds its way into regular use.

A third regular trouble has been the breakage of outer rings though this is not so serious because new rings can be applied by the user, but it is very expensive.

These difficulties are all met and solved in the construction of the Ohio mill type magnet as follows: All electric circuit joints in the magnet are braze-welded. All coil insulation is impregnated asbestos; $\frac{1}{4}$ -inch between coil layers; $\frac{1}{2}$ -inch top and bottom; $\frac{3}{4}$ -inch moulded around the center.

Bakelite varnish is used to impregnate the asbestos ribbon between turns, and asphaltum to seal the magnet assembly against moisture.

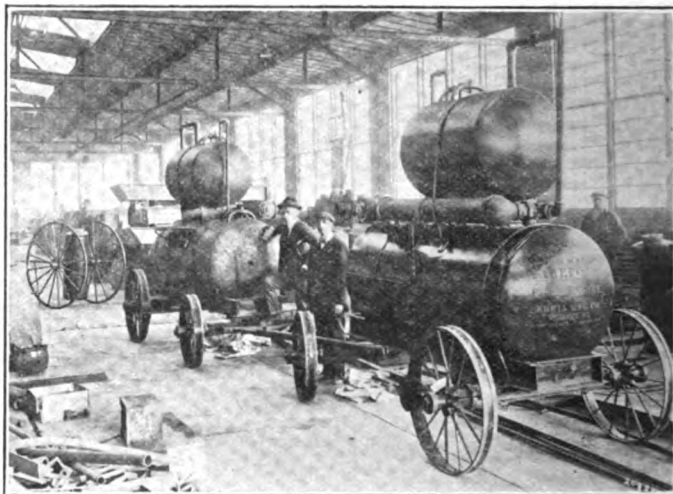
The outer ring is over 8 inches high, and of minimum cross section over 16 square inches in the No. 5, and proportionately large in the other sizes. There are no through holes, the ring being supported by large chrome vanadium steel studs with nuts

on top positively locked to studs and to case, and thoroughly protected by a strong annular rib.

The coil strapped to the center coil ring is a unit and being clamped solid between case and bottom plate the heat of operation is rapidly radiated, hence the temperature rise for a two-hour run, one minute on and one minute off, is not over 75 degrees Centigrade. The result is a high operating current and an all-day lifting capacity.

FIRE EXTINGUISHERS FOR INDUSTRIAL PLANTS.

Due to the increasing fire hazard in all industries particular attention is now being paid to methods for combatting this danger. Among the successful appliances which have been placed on the market the "fire-foam" apparatus, manufactured by the Erwin Manufacturing Company, of Milwaukee, Wis., which has been installed in a number of steel plants, is of particular interest. The portable type engine shown in the illustration consists chiefly of two cylindrical tanks containing the chemicals which, when brought in contact with each other produce the product called "fire-foam." The apparatus which has been approved by the Underwriters' Laboratories, and adopted to some extent by the



Erwin portable 500-gallon engine, which generates 5,000 gallons of "fire foam."

United States Steel Corporation, is easily transported, thus giving it a wide range of use.

This method of fighting fires is not entirely new, having been partly developed by the foreign governments and adopted by the United States Navy.

"Fire-foam" floats on burning oils, gasoline, varnish, chemicals, etc., and smothers such fires instantly. Fire chiefs who know that sheets of burning oils are only spread by streams of water will appreciate this valuable property. The apparatus is furnished chiefly in large units to handle dangerous risks. One large unit usually being more effective than 50 small ones. The engine can be quickly recharged. The prepared chemicals dissolve in cold water instantly. The portable outfits can be taken apart and recharged in two minutes. Recharges consist of clean, dry powder, packed in packages ready for use. This apparatus will be of interest to those engaged in watching the numerous hazards

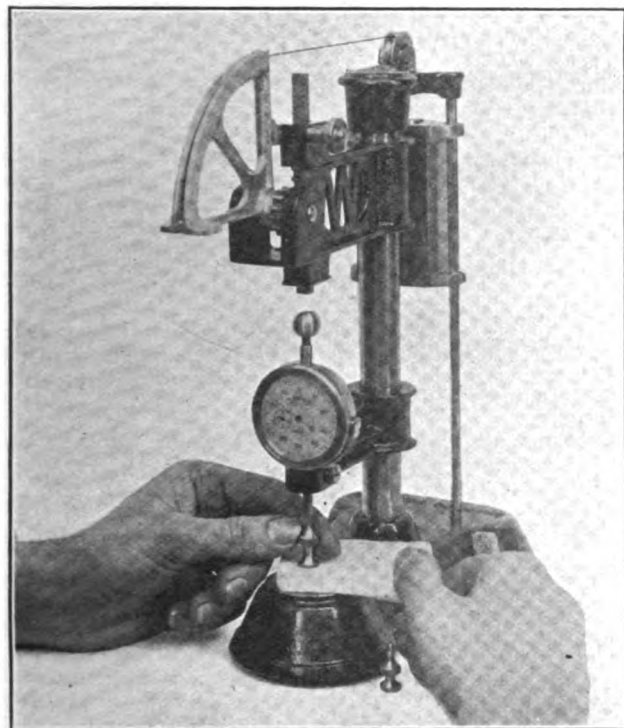
WITH THE EQUIPMENT MANUFACTURERS

of considerable importance in the industry, among which the following are the most important:

Fuel oil tanks used for supplying fuel to heating furnaces; open hearths, annealing furnaces, etc.; electrical apparatus; powder coal plants; power plants, including coal storage bins, etc.; oxy-acetylene apparatus; by-product coke plants where considerable tar, pitch and benzol are present; auxiliary shops, such as pattern shops and machine shops.

WIDNEY RESILIOMETER.

The "resiliometer" is an instrument for testing the thickness, hardness, and resiliency or "life" of any resilient materials such as are used for washers, packing, gaskets, shock absorbers, etc. The tests made with this instrument may be used as a guide in the purchase of mechanical felt, rubber, and similar materials. The accompanying illustration shows the instrument being used to determine the thickness of material. The thickness of this particular sample is 0.283 inch, which is the normal or natural



Appliance for testing thickness, hardness and resiliency of resilient materials.

thickness. The large dial of the gage is graduated to thousandths of an inch, and one revolution of the large pointer is equivalent to one-tenth inch. If the material is more than one-tenth inch thick, thus causing the indicator hand to make more than one complete revolution around the dial, the reading is indicated by first noting the position of the indicating hand of the small dial, which is inside the face of the larger one.

In order to ascertain the degree of hardness of the material, a spring catch is released which holds the weight suspended at the rear of the instrument, thus allowing the quadrant to which the weight is attached by a wire, to swing back until the presser-foot of the dial gage is subjected to pressure due to the weight. This presser-foot then sinks into the material, thus reducing the

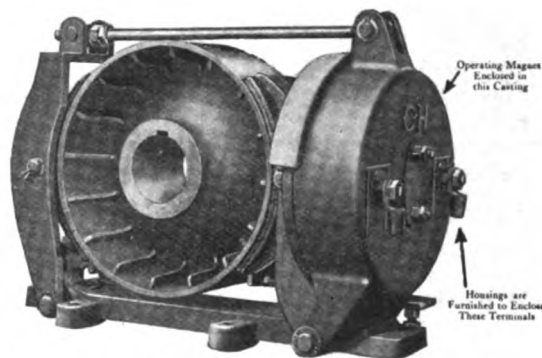
thickness at this point as indicated by a backward movement of the indicating hand of the dial gage. This reading is then compared with the normal or original reading. For instance, of the normal thickness were 0.283 inch and the thickness under pressure 0.111 inch, this would indicate that the material was 39.2 per cent hard, according to the Widney standard. If the material were not compressed at all, this hardness would be 100 per cent—an impossibility with any resilient material.

The resiliency of any compressible material, such as felt, rubber, etc., is indicated by its capacity to recover from compression. To make the resiliency test, the quadrant is pulled back, thus releasing the pressure on the presser-foot. As soon as the weight and pressure are released, the hand of the dial gage again moves forward and the reading should be taken immediately in order to ascertain the "instant resiliency" and not the gradual return to the normal thickness. If the reading under pressure were 0.111, as previously mentioned, and the thickness reading 0.200 as soon as the pressure was released, the rebound or resiliency would be equivalent to 0.089 inch ($0.200 - 0.111 = 0.089$ inch), which is 51.7 per cent of the possible rebound.

The hardness and resiliency readings vary with the thickness of the material; the greater the thickness, the greater the resistance to penetration, so that a higher hardness reading is obtained. The resiliency reading also increases at a ratio of approximately one-half the increase in the hardness reading. The resiliometer is manufactured by the Advance Felt Specialty & Cutting Co., 320 S. Jefferson street, Chicago, Ill.

MAGNET-OPERATED BRAKE.

Recent improvements in the magnet-operated brake built by the Cutler-Hammer Manufacturing Company, of Milwaukee, have given it several distinguishing features. By lowering the



Magnet-operated brake.

position of the magnet and making the magnet armature an integral part of one of the arms carrying the brake shoes, the construction has been simplified, fewer parts are required, compactness is secured, and the parts made extremely strong and rugged without adding excessive weight. The new design requires less head room, as it is but slightly higher than the brake wheel—a point to be considered when a brake of this kind is to be installed on a crane, hoist, or bridge. Many desirable operating features also have been secured. The brake is applied by means of a spring, located in the center of the coil, which tends to force the armature and magnet apart. The force acts directly in line with the center of the brake shoes, thus the operation is not affected by any wear in the brake linkage.

Trade Notes

The Quigley Furnace Specialties Company, Inc., has secured a contract for installing a powdered coal system at the Beach Bottom plant of the Whitaker-Glessner Company. The installation is to be operated in connection with shell forging furnaces.

The Pittsburgh Steel Company has recently adopted the Orth roof in connection with their open hearth furnaces.

The address of the Toronto office of the Metal Thermit Corporation has been changed to 15 Emily street, Toronto, Ontario.

The Carnegie Steel Company, Pittsburgh, has placed a contract with the Bartlett-Snow Company, Cleveland, for a Dwight-Lloyd sintering plant, to be installed at its three blast furnaces at Farrell, Pa. The plant will have a daily capacity of about 350 tons of finished sinter, and is expected to be completed about April 1.

Furnace No. 1, of the American Mangane Manufacturing Company, at Dunbar, Pa., which has been running for some time on forge iron, is now operating on spiegeleisen. Stack No. 2 is being relined and repaired, but will be ready for blast in a short time.

The Walter A. Zelnicker Supply Company recently secured the services of Merle G. Peterson, who is now connected with the company's Chicago sales force at 428 First National Bank building. Mr. Peterson was formerly associated with the Niles-Bement-Pond Company and Pratt & Whitney Company. His father, Carl Peterson, is Western representative of the Baldwin Locomotive Works, with offices at Chicago, Ill.

Walter A. Zelnicker Supply Company has recently added to its sales force Henry Stroh. For the past 10 years Mr. Stroh was connected with the Elliott Frog & Switch Company, prior to which time he was associated with the Republic Iron & Steel Company, both of East St. Louis.

The Vulcan Iron Works, Jersey City, N. J., has purchased the steam boiler plant of the Theo. Smith & Sons Co., Jersey City. The Vulcan Iron Works has a contract with the Emergency Fleet Corporation for marine boilers.

Frederick Grant, superintendent of the New Jersey Slag Products Company, Dover, N. J., has resigned to enter the engineers' training camp at Indianapolis, Ind.

Trade Publications

Air Compressors—A four-page folder is being circulated by the Spencer Turbine Cleaner Company, Hartford, Conn., describing a slow-speed turbine which is used in supplying air for oil and gas burning furnaces, foundry cupolas, and

in connection with pneumatic tube and conveying apparatus, etc. The blower is motor driven and operates at 1,750 revolutions per minute.

Mill Magnets—The Ohio Electric & Controller Co., Cleveland, describes the construction of their lifting magnets in a booklet recently issued by them. Tables containing lifting capacities of magnets and current requirements are contained in the booklet.

Coal Conveyor—A coal conveyor operated by means of an electrically-driven hoist and capable of storing 1,000 tons of coal to each 100 feet of conveyor track is described in a leaflet issued by the John F. Godfrey Company, Elkhart, Ind.

Air Equipment—The Cleveland Pneumatic Tool Company, Cleveland, O., has issued a folder describing their four-position air drills, geared air drills, light weight four-piston air drills, corner drills, rotary breast drills, air riveters, sand hammers and hose couplings.

Trucks—Trucks having a 4,000-pound carrying capacity and built in several models are described in a booklet circulated by the Abell-Howe Company, Chicago.

Cranes—Cranes ranging from 1 to 200 tons, of all types are described in Bulletin No. 100 M, recently issued by the Cleveland Crane & Engineering Co., Wickliffe, O. Many types are illustrated.

Forges—The Buffalo Forge Company, Buffalo, has published a catalogue No. 100, which describes their line of stationary forges. The catalogue illustrates each unit.

Pull Switches—"War-Time Control of Light," is the title of a new four-page envelope folder, known as publication 271, being distributed by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The folder points out that current, copper and coal, may be saved by the judicious use of pull switches properly placed, thus permitting lights not needed to be promptly cut out of circuit. C-H pull switches have the high capacity rating of six amperes at 125 volts, which makes them of particular value for controlling large groups of lamps, as for instance, in indirect lighting units where a switch of only three amperes' rating would be of insufficient capacity. These pull switches are made with various sizes and styles of caps. One number has a large porcelain base to fit a standard 3/4-inch outlet box.

Powdered Coal—The Locomotive Pulverized Fuel Company, New York, explains and describes the results obtained with one of the company's combination pulverized fuel feeding and mixing devices in burning Rhode Island graphitic anthracite coal in a finely divided state, in their Bulletin No. 5.

Steel Bars—W. J. Crouch Company, Inc., New York, describe the complete process of manufacturing a steel bar. The process is taken up from the time the ore is mined until the product emerges from the bar mill.

Coke Oven Machinery—Wellman-Seaver-Morgan Company, Cleveland, point out the important features of some types of this company's coke oven machinery, in a bulletin just issued.

Obituary

William H. Connell, treasurer of the American Bridge Company, died August 5, at Wilmington, Del. Mr. Connell was recognized as being one of the foremost bridge engineers of the United States.

Richard Paxton, assistant mechanical engineer for the American Bridge Company, Ambridge, Pa., dropped dead at Sewickley, Pa., following a round of tennis.

Edgar Robinson died at Youngstown, O., July 20. Mr. Robinson was for many years prominently identified with the iron industry of Massachusetts. He leaves three sons, T. W. Robinson, vice president of the Illinois Steel Company; C. S. Robinson, vice president of the Youngstown Sheet & Tube Co., and D. P. Robinson, for a number of years a partner of Stone & Webster, Boston.

James Damez, president of the Damez Foundry Company, died July 16 in Chicago, following injuries sustained at his plant, on account of the breaking of an emery wheel.

Simon C. Collin, aged 78, of Braddock, Pa., and former chief engineer of the Pittsburgh Locomotive Works, died last month at Washington, D. C. He was also connected with the Edgar Thomson Steel Company, and with the Pencoyd Steel Company.

Charles E. Pennock, one of the pioneer iron masters of Chester county, Pa., and one of the oldest citizens of Coatesville, died August 7.

Society Meetings

American Chemical Society, Cleveland, O., September.

American Society of Sanitary Engineers, Chicago, Ill., September.

American Institute of Mining Engineers, Colorado, September 2-7.

National Association of Stationary Engineers, Cincinnati, O., September 9-13.

Association of Iron, Steel and Electrical Engineers, Baltimore, Md., September 11-14.

British Iron and Steel Institute, London, England, September 12-13.

National Exposition of Chemical Industries, New York, N. Y., September 23-28.

American Electrochemical Society, Princeton, N. J., September 30-October 2.

Institute of Metals Division, A. I. M. E., Milwaukee, Wis., October 8-11.

Iron and Steel Members, A. I. M. E., Milwaukee, Wis., October 8-10.

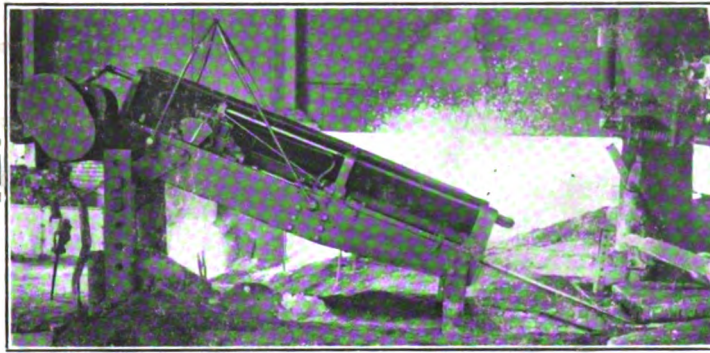
American Foundrymen's Association, Milwaukee, Wis., October 7-12.

National Safety Council, St. Louis, Mo., September 16-20.

Business show, New York, N. Y., October 21-16.

The Blast Furnace *and* Steel Plant

Pittsburgh, September, 1918



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Take away the danger of Blast Furnace Tapping—No dangerous driving of tapping bars. No pricking rods. No men at the furnace front. How?

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The 100% safe method of tapping. Moreover it insures getting your iron just where you want it. The iron floor is free, smooth and uninterrupted, sputtering or splashing from irregular tapping holes is avoided. The machine performs the whole operation, does away with slow uncertain methods and eliminates tapping accidents. Saves man power.

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